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# The Structure of the Amazonian vegetation

## II. Tropical Rain Forest

by

Masayuki TAKEUCHI\*

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With 7 Figures, 3 Tables and 5 Diagrams

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### Introduction

Carpenter, J. R. (1938) said, "Ecology is the science of communities, and essentially an observational study". Croizat, L. (1952) thought that the phytogeography was a branch of botany to interpret plant-migrations in time and space. We know the present vegetation, the present communities of plant, exists as a result of the longstanding and continuous succession. Therefore phytoecology has some connections with phytogeography.

Dansereau, P. (1957) said, "The present *ecological perspective* embraces the entire field of the sciences of environment. This comprehensive ensemble, sometimes labelled biogeography, studies the origin, distribution adaptation and association of plants and animals".

I almost agree with this latter theoretical sentence, but biogeography and ecology each has a different purpose and a different method of study. For example, ecology does not include the historical relation. Even if it includes the time of succession, the time is very short as compared with the historical one. Ecology also does not include the relation of heredity. While environmental conditions are very important for ecology.

Otherwise, in the phytogeography the historical time and the hereditary relation are as important as the distribution and classification of plants. I understand phytoecology differs from phytogeography, although phytoecology has some connections with phytogeography.

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Now, I shall introduce the interest phrase from the last sentence of Croizat's, "Why do you theorize instead of looking at the facts straight in the face? Please, give them an opportunity to speak their message while you learn". This is a principle of natural science at the beginning stage. I can not agree with all of

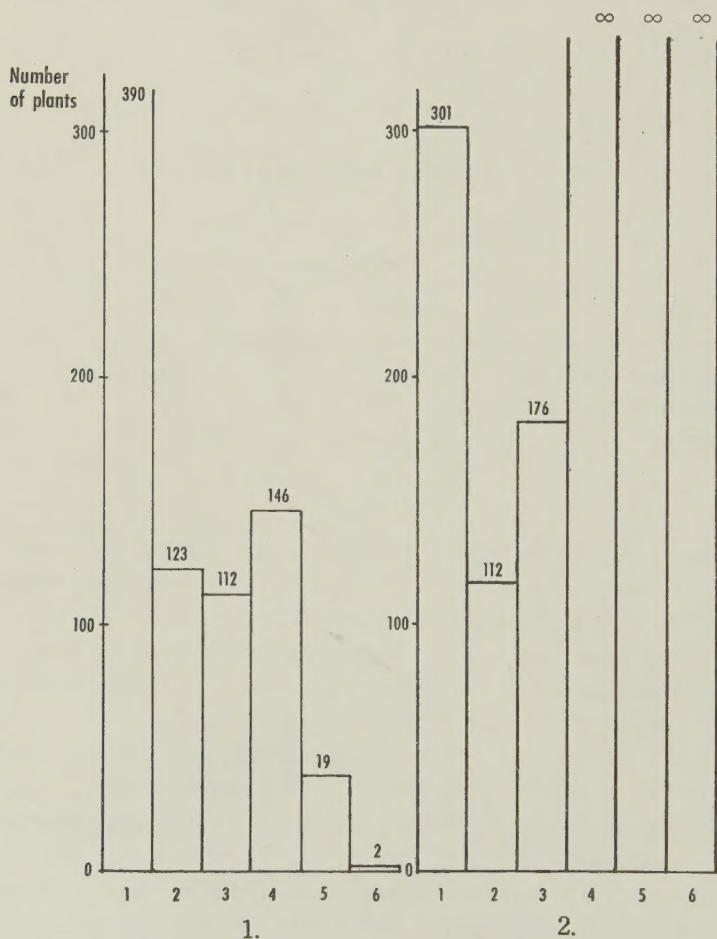


Diagram 1. The column diagrams of the constituent of the forest. Each column represents the number of plants in each life form. 1: small trees or shrubs, 2: trees, 3: palms, 4: ground herbs, 5: epiphytes, 6: saprophytes or parasites.

1. The diagram of the high "terra firme" ( $10 \times 160 \text{ m}^2$ ).
2. The diagram of the low "terra firme" ( $10 \times 220 \text{ m}^2$ ).

his opinion, because the natural science requires not only the record of facts, but also the generalization of the records and some experiments, i. e. in ecology the modification of the environmental conditions in the field and the experiments of transplantation and of physiology in the laboratory, etc. I suppose that Croizat



served only a warning on the phytogeographers as theorists.

Ecology and geography of plants in the Amazonian region remain in the stage of observation under existing conditions.

I present here the result of investigations on the structures of Amazonian forest from an angle of ecology and some statistical studies.

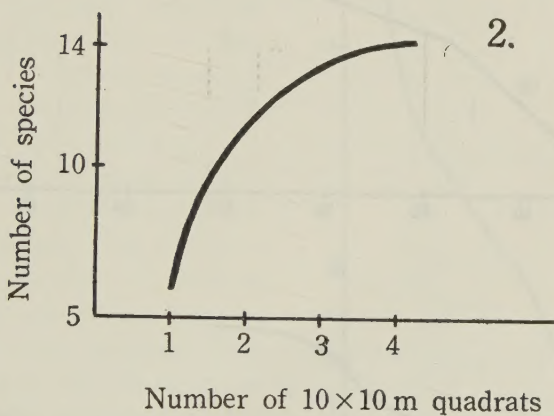
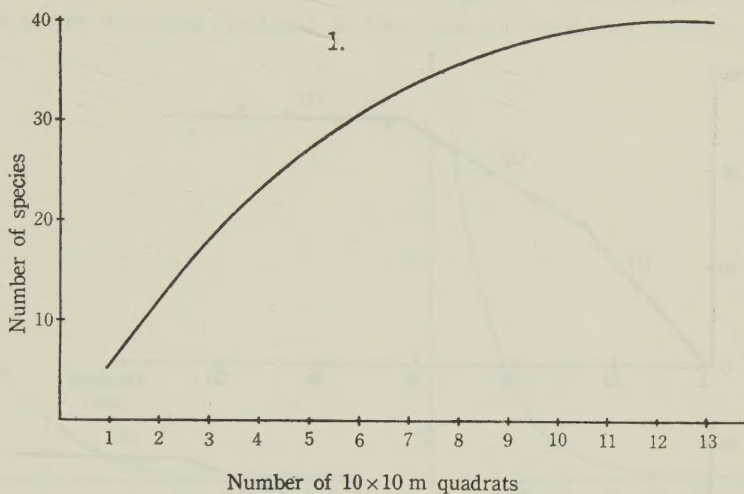


Diagram 2. The relation between the number of species and the number of 10×10 m quadrats.

1. The diagram of the high "terra firme".
2. The diagram of the inclined "terra firme".

The word "structure" in the title is used in the sense of the organization in space of the individuals as in Dansereau's Biogeography (1957).

Investigated places are situated at 42 km. north-northeast of Manaus city in Brazil, and are covered with the tropical rain forest (Hylaea, Urwald, Jangle).

This forest is one of the typical Amazonian forest on the "terra firme". The soil is clayey sand and covered with few centimeters of humus. For this investigation, I used the following modified method of Richards'. The narrow sample strip of the forest is marked out with cords as serial  $10 \times 10 \text{m}^2$ . Diameters of trees, basal lengths of buttresses when present, extension of adventitious roots when present and the positions of trees, palms and lianas are then mapped on the

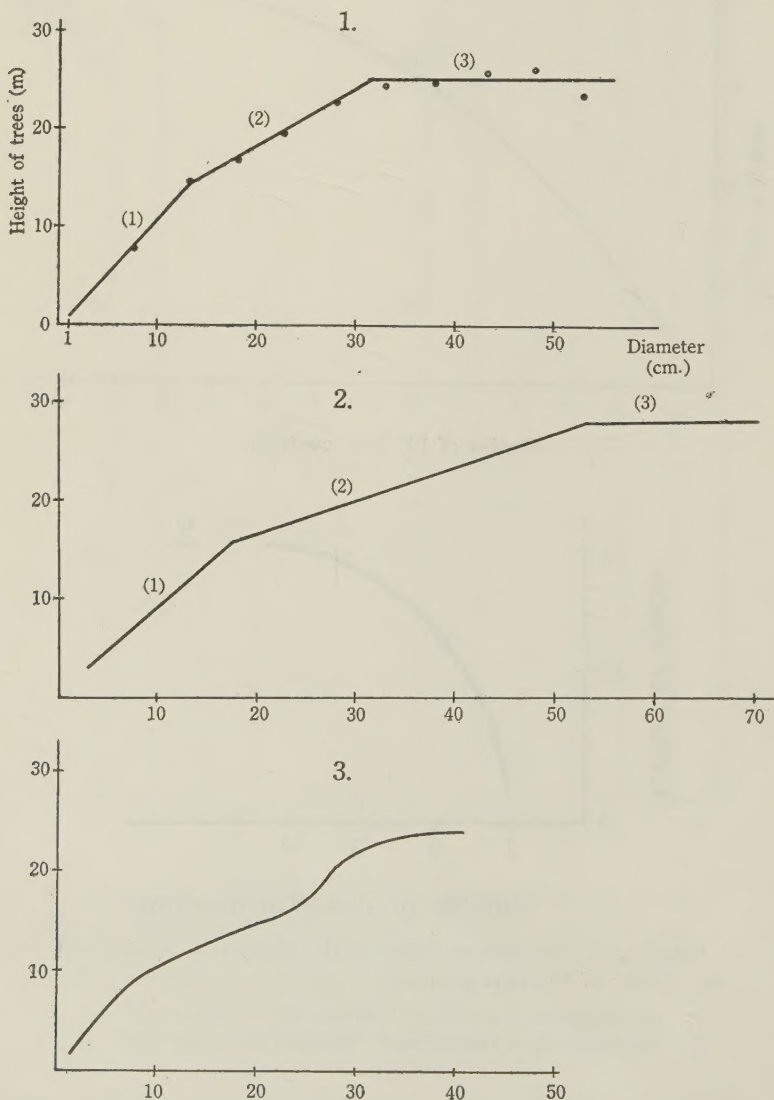


Diagram 3. The relation between height and diameter of the trees. 1. The diagram of the high "terra firme". (1):  $y=ax$ , (2):  $y=ax+b$ , (3):  $y=b$ . 2. The diagram of the low "terra firme". 3. The diagram of the inclined "terra firme".



plan of narrow rectangular strips. The total height, the height to the first large branch, the lower limit of the crown, the width of the crown, the height of the buttresses and of the adventitious roots and the forms of each tree are measured and recorded and then mapped on the elevation. From the results of all measurements are made the statistic tables and diagrams.

In this paper, I determined the name of species with the kind aid of the members of the Instituto Nacional de Pesquisas da Amazônia, Manaus, Brazil.

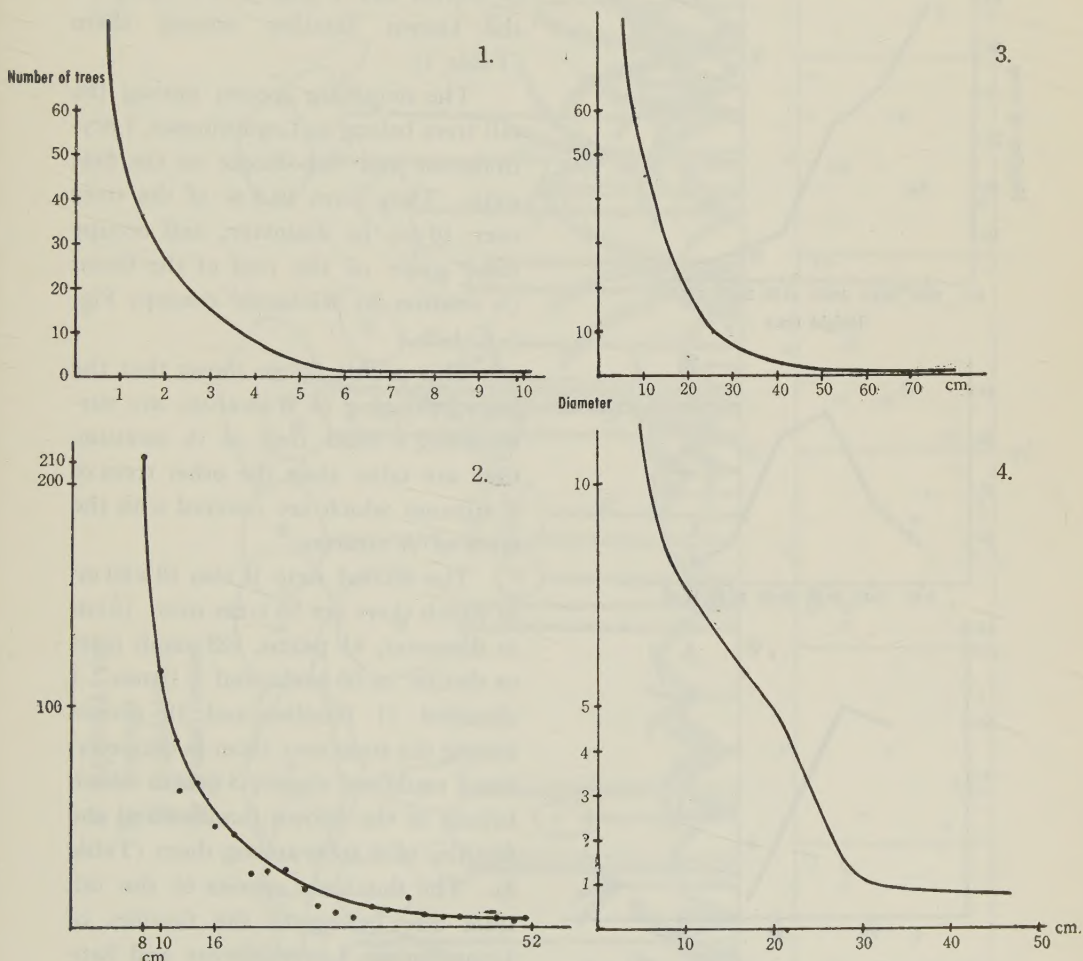


Diagram 4. The relation between diameter and number of trees. 1. The diagram of the high "terra firme". This curve is a hyperbola  $y = \frac{K}{x}$  like the curve of Ducke's forest land. The numbers of diameter show as follows: 1=10—20 cm, 2=20—30 cm, and so on in each interval. 2. The diagram of the Ducke's forest land. (one hectare). 3. The diagram of the low "terra firme". 4. The diagram of the inclined "terra firme".

### Rain forest on the high "terra firme"

I prepared the three sample strips on the high "terra firme", which is about 60 m above the sea level.

The first strip is  $10 \times 60 \text{ m}^2$  (Fig. 1-1, 1-2). There are 34 trees over 10 cm in diameter, 29 palms, 151 small trees or shrubs, 17 herbs and 6 lianas. I classified 12 families and 16 genera among the trees over 10 cm in diameter. But I could

not determine the name of the family of 4 trees and 6 genera belonging to the known families among them (Table 1).

The dominant species among the tall trees belong to Leguminosae, Lecythidaceae and Sapotaceae on the first strip. They form 40.8 % of the trees over 10 cm in diameter, and occupy most space of the roof of the forest (A stratum by Richards' concept Fig. 1-1, 1-2).

This profile figure shows that the trees belonging to B stratum are surrounding a dead tree of A stratum, they are taller than the other trees of B stratum which are covered with the trees of A stratum.

The second strip is also  $10 \times 60 \text{ m}^2$  in which there are 50 trees over 10 cm in diameter, 41 palms, 128 small trees or shrubs, ca.60 herbs and 7 lianas. I classified 11 families and 19 genera among the trees over 10 cm in diameter, but I could not classify 3 genera which belong to the known families and the families of 9 trees among them (Table 2). The dominant species of the tall trees also belong to the families of Leguminosae, Lecythidaceae and Sapotaceae on the second strip. They form 44.0% of all trees over 10 cm in diameter and belong to the members of the roof of the forest (Fig. 2-1, 2-2).

The third strip is  $10 \times 65 \text{ m}^2$  in which there are 41 trees over 10 cm in

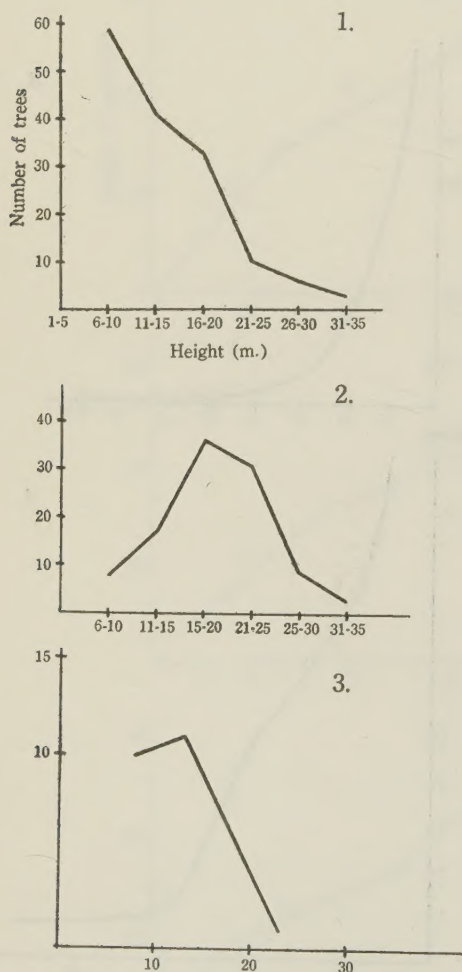


Diagram 5. The relation between height and number of trees over 10 cm in diameter.

1. The diagram of the high "terra firme".
2. The diagram of the low "terra firme" shows normal curve.
3. The diagram of the inclined "terra firme" shows intermediate character between the above two curves.



diameter, 44 palms, 111 shrubs or small trees, ca. 30 herbs and 3 lianas.

I classified 23 genera and 12 families among the trees over 10 cm in diameter, and could not classify one genus which belongs to Leguminosae and families of 7

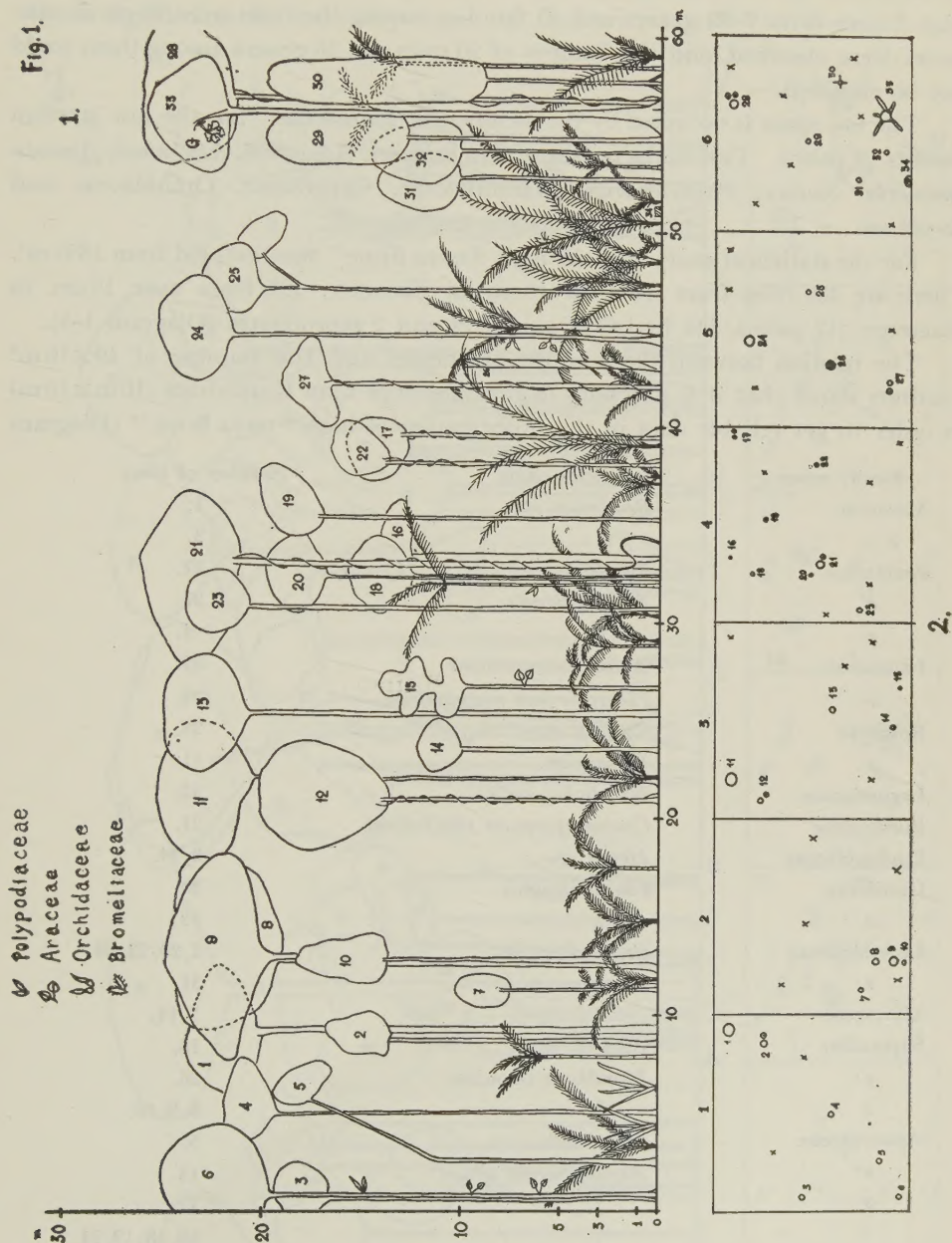


Fig. 1-1. The profile figure of the primary tropical rain forest on the high "terra firme" (the first strig  $10 \times 60 \text{ m}^2$ ). The figure shows the B stratum around the dead tree is somewhat tall. Fig. 1-2. The plan figure of Fig. 1-1.

trees among them. The dominant species of the tall trees belong to Moraceae, Leguminosae, Lecythidaceae and Sapotaceae. They form 53.6 % of the trees over 10 cm in diameter (Table 3, Fig. 3-1, 3-2).

As the result of the investigation of the three sample strips, on the 1850 m<sup>2</sup> high "terra firme" 32 genera and 15 families among the trees over 10 cm in diameter were classified, and the families of 20 trees and 10 genera among them could not be classified.

The low space is occupied by the members of Palmaceae. So, the low stratum consists of palms. Few herbs consist of *Trichomanes*, *Adiantum*, *Asplenium*, *Ananas*, *Bromeria*, *Smilax*, *Phylodendron*, Maranthaceae, Cyperaceae, Orchidaceae and *Strychnos*.

For the statistical study 1600 m<sup>2</sup> high "terra firme" was sampled from 1850 m<sup>2</sup>. There are 390 trees from 1 cm to 10 cm in diameter, 123 trees over 10 cm in diameter, 112 palms, 146 herbs, 19 epiphytes and 2 saprophytes (Diagram 1-1).

The relation between the number of species and the number of 10×10 m<sup>2</sup> quadrats shows that it is necessary to examine more than 11 quadrats (10 m×10 m) in order to get reliable data in the investigation of high "terra firme" (Diagram

Family name	Species name	Number of trees
Moraceae	<i>Brosimum</i> sp.	1.
"	?	3.
Anonaceae	<i>Xylopia marginata</i>	22.
"	<i>X. brasiliensis</i>	27.
"	?	4.
Lauraceae	<i>Aniba rostrmanniana</i>	25.
"	<i>Pleurothryum macranthum</i>	29.
Rosaceae	<i>Couepia elata</i>	33.
"	<i>Licania</i> sp.	11.
Leguminosae	<i>Bowdichia nitida</i>	32.
Burseraceae	<i>Creoidospermum rhoifolium</i>	21.
Euphorbiaceae	<i>Hevea</i> sp.	8, 34.
Guttiferae	<i>Clusia insignis</i>	30.
"	?	12.
Lecythidaceae	<i>Eschweilera</i> sp.	2, 20, 23, 28.
"	<i>E. matamata</i>	31.
Myrtaceae	?	7, 14.
Sapotaceae	<i>Lucuma</i> sp.	15.
"	<i>Manilkara inundata</i>	26.
"	?	6, 9, 10.
Apocynaceae	<i>Himatanthus</i> sp.	5.
"	<i>Aspidosperma album</i>	13.
"	?	17.
?	?	16, 18, 19, 24.

Table 1. The constituent trees on the first strip of the high "terra firme"  
The numbers of trees on this table agree with the numbers of Fig. 1-1  
and Fig. 1-2.



2-1). Many former observers used less than the upper number of quadrats.

The relation among height, diameter and number of tree is arranged as a dispersal table (Table 4). The relation between height and diameter of trees is drawn as a linear diagram (Diagram 3-1). This diagram shows three tendencies, one is signified as the formula  $y=ax$ .....(1), another is signified as  $y=bx+c$ .....(2),

Fig. 2.

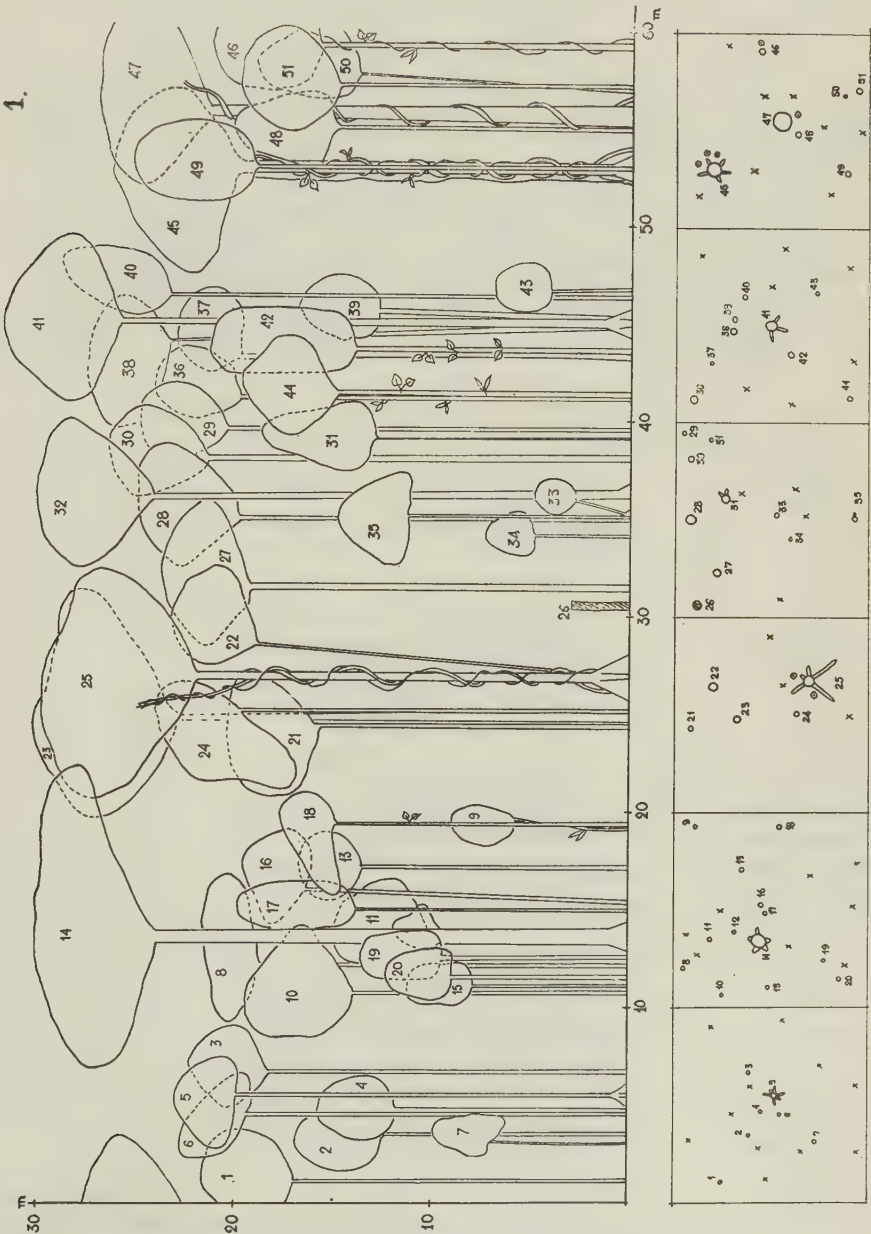


Fig. 2-1. The profile figure of the primary tropical rain forest on the high "terra firme" (the second strip 10×60m<sup>2</sup>). Fig. 2-2. The plan figure of Fig. 2-1.

Fig.2.

3.



Fig. 2-3. The profile figure of the palms on the same locality of Fig. 2-1 (10×20m<sup>2</sup>). This figure shows the high density of Palmae.

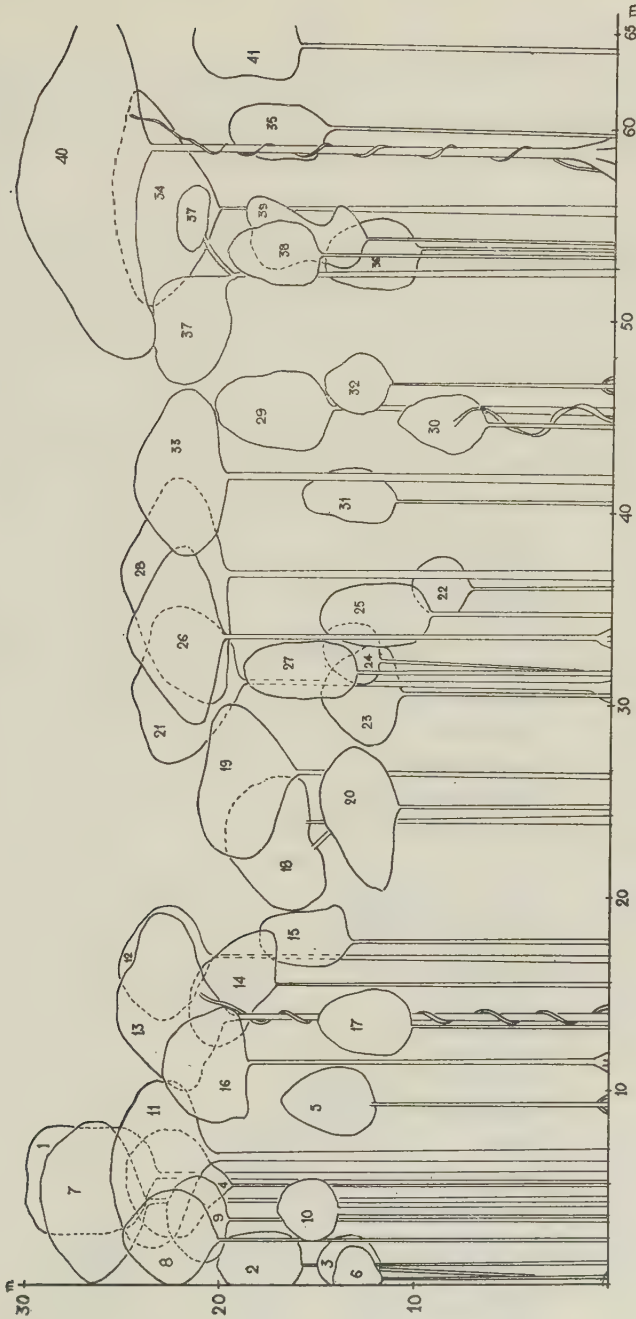
Family name	Species name	Number of Trees
Moraceae	<i>Brosium</i> sp.	2, 6, 14.
Lauraceae	<i>Aniba rostrmanniana</i>	17, 29.
"	<i>Aniba</i> sp.	49.
Rosaceae	<i>Couepia elata</i>	12, 41.
"	<i>Licania scabra</i>	36, 48.
Leguminosae	<i>Bowdichia nitida</i>	9, 13.
"	<i>Pithecolobium</i> sp.	11.
"	<i>Hymenaea coubaril</i>	24.
"	<i>Sclerobium chrysophyllum</i>	32.
"	?	25, 43.
Burseraceae	<i>Protium</i> sp.	18, 37.
Euphorbiaceae	<i>Hevea brasiliensis</i>	26.
Bombacaceae	<i>Catostemma micranthum</i>	27, 38.
Humiriaceae	<i>Saccoglottis amazonia</i>	44.
Lecythidaceae	<i>Eschweilera matamata</i>	16, 22, 42.
"	<i>E. polyantha</i>	40.
"	<i>E.</i> sp.	21, 31.
"	<i>Lecythis paraensis</i>	47.
"	<i>Bertholletia excelsa</i>	23.
Sapotaceae	<i>Pauteria cyrtobotrya</i>	1.
"	<i>Lucuma</i> sp.	5, 10, 34, 35, 45.
"	<i>Manilkara inundata</i>	46.
"	?	50.
Apocynaceae	<i>Parahancornia amapa</i>	39.
"	?	8.
?	?	3, 4, 9, 19, 20, 28, 30, 33, 51.

Table 2. The constituent trees on the high "terra firme". The numbers of trees of this table agree with the numbers of Fig. 2-1 and Fig. 2-2.



Fig. 3.

1.



2.

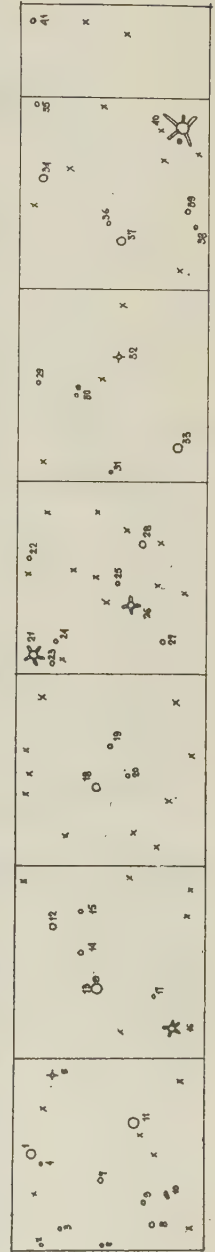


Fig. 3-1. The profile figure of the primary tropical rain forest on the high "terra firme" (the third strip  $10 \times 65 \text{ m}^2$ ). Fig. 3-2. The plan figure of Fig. 3-1.

the last one is signified as  $y=d.....(3)$ . The formula (3) means that the height of the tree has the limitation.

The relation between diameter and number of trees can be shown as a typical hyperbola,  $y=\frac{k}{x}$  (Diagram 4-1). This hyperbola is the same as that of Ducke's Forest Land at 19 km north of Manaus city (Diagram 4-2). The hyperbolae of diameter and number of trees signify the typical tropical rain forest on the high "terra firme".

I made the relation between height and number of trees over 10 cm in diameter a linear diagram (Diagram 5-1). This diagram shows that many trees are below 10 m in height, that trees from 11 m to 20 m in height are less than the trees below 10 m in height and that trees over 20 m in height are few. This difference of the number of trees corresponds with the structure of the forest which has three strata.

The lowest stratum consists of many palms, small trees and shrubs, and the dominant group is the palm (Fig. 1-1). The community of the palm consists of

Family name	Species name	Number of trees
Moraceae	<i>Chlorophora tinctoria</i>	5.
"	<i>Pourouma myrmecophila</i>	6.
"	<i>Brosium</i> sp.	18, 23.
Olacaceae	<i>Agonandra brasiliensis</i>	10.
Lauraceae	<i>Aniba rosmanniana</i>	41.
"	<i>Aniba</i> sp.	36.
"	<i>Ocotea guianensis</i>	39.
Rosaceae	<i>Couepia elata</i>	8.
"	<i>Licania heteromorpha</i>	32.
Leguminosae	<i>Enterolobium schomburgkii</i>	17.
"	<i>Sclerolobium micropetalum</i>	28.
"	<i>Aldina heterophylla</i>	29, 38.
"	<i>Bowdichia nitida</i>	35.
"	?	40.
Linaceae	<i>Vantanea</i> sp.	21.
Burseraceae	<i>Protium</i> sp.	20.
Euphorbiaceae	<i>Hevea</i> sp.	1.
Bombacaceae	<i>Catostemma micranthum</i>	31.
Lecythidaceae	<i>Eschweilera polyantha</i>	4.
"	<i>E.</i> sp.	13, 19, 34.
Sapotaceae	<i>Chrysophyllum cyanogenum</i>	2, 14.
"	<i>Manilkara inundata</i>	33.
"	<i>Lucuma</i> sp.	9, 15, 26.
"	<i>Ecclinusia spuria</i>	12.
Apocynaceae	<i>Aspidosperma album</i>	7.
"	<i>Parahancornia album</i>	22, 24.
?	?	3, 11, 16, 25, 27, 30, 37.

Table 3. The constituent trees on the third strip of the high "terra firme". The numbers of trees in this table agree with the numbers of Fig. 3-1 and Fig. 3-2.



Height (m.)	6-10	11-15	16-20	21-25	26-30	31-35	Total	Mean	s.	c.
Diameter (cm.)										
11-15	7	11	12	3			33	14.6	1.8	0.12
16-20	1	4	9	2			16	16.7	2.9	0.17
21-25		1	11	5			17	19.1	1.9	0.09
26-30		1	3	3	2		9	22.4	5.4	0.24
31-35				4	1		5	24.0	2.0	0.08
36-40			1	4	2	1	8	24.8	3.9	0.15
41-45				4	3		7	25.1	1.4	0.05
46-50				3		1	4	25.5	4.5	0.17
51-55				2			2	23.0	0	0
56-60							0	0	0	0
61-65							0	0	0	0
66-70						1	1	33.0	0	0
71-75							0	0	0	0
76-80					2		2	28.0	0	0
Total	8	17	36	30	10	3	104	—	—	—

Table 4. Dispersal table of the relation among height, diameter and number of trees on the high "terra firme" ( $10 \times 160 \text{ m}^2$ ).

Total: total number of trees, s: standard deviation, c: coefficient of variation.

several species: *Geonoma brogniartii*, *Astrocaryum paramaceae*, *Oenocarpus bacaba* and *Attalea* sp. I did not draw palms on Fig. 2-1 and Fig. 3-1, because it was afraid to lose the exact composition of the tall trees. Fig. 2-3 is the profile figure of palms on  $10 \text{ m} \times 20 \text{ m}$  high "terra firme" except the other plants. This figure shows the crowded community of palms. The trees over 10 cm in diameter, in  $10 \text{ m} \times 10 \text{ m}$  high "terra firme", are few as shown on three plan figures, while there are many palms.

The largest tree in diameter is *Lecythis paraensis* (Fig. 2, No. 47) and has 115 cm in diameter.

The tallest trees are *Couepia elata* (Rosaceae) and a species of Leguminosae on the three strips, both trees are over 30m. high (Fig. 2, No. 41; Fig. 3, No. 40).

The trees having large buttresses are *Couepia elata* (Fig. 1, No. 33; Fig. 2, No. 14 & 41), *Brosium* sp. (Fig. 2, No. 14), *Lucuma* sp. (Fig. 2, No. 5 & 45; Fig. 3, No. 26), a species of Leguminosae (Fig. 2, No. 25; Fig. 3, No. 40) and *Vantanea* sp. (Fig. 3, No. 21),

The data of buttresses are as follows:

	a (cm)	b (cm)	c (cm)	c/a	b/a
<i>Lucuma</i> sp.	130	130	76	0.58	1.00
"	62	70	25	0.42	1.13
"	64	57	23	0.36	0.89
<i>Couepia elata</i>	150	150	50	0.33	1.00
(Leguminosae)	240	200	45	0.18	0.83
"	282	340	70	0.25	1.20
<i>Vantanea</i> sp.	195	150	45	0.23	0.77
<i>Sclerolobium</i> sp.	150	100	40	0.27	0.67
<i>Brosium</i> sp.	240	200	80	0.33	0.83

<i>Protium</i> sp.	150	120	48	0.33	0.83	
"	100	70	40	0.40	0.70	
<i>Eschweilera</i> sp.	50	50	38	0.76	1.00	
a: sum of two basal lengths of the largest buttresses.				Total	4.43	10.82
				Mean	0.37	0.92
b: height of the highest buttress.				s	±0.16	±0.16
c: diameter at the upper and of buttress.				c	0.43	0.17

Table 5. The result of the measurement of the buttresses on the high "terra firme".

This table shows the value of  $b/a$  is  $0.9 \pm 0.16$  ( $s$ =standard deviation) and the coefficient of variation of  $b/a$  is 0.17.

Therefore, the basal width and the height of buttress are almost the same, but the value of  $c/a$  is 0.37, the standard deviation of  $c/a$  is  $\pm 0.16$  and the coefficient of variation of  $c/a$  is 0.43. Therefore even if the basal width of buttress is large, the diameter of trees is not always large.

#### Rain forest on the low "terra firme"

I prepared three sample strips on the low "terra firme" which is about 40m above sea level. Each of two sample strips is crossed by stream (igarapé) and is muddy ground (lama). The other one is a damp ground and has not a stream, but on rainy days it becomes like a stream owing to running rain-water, and the surface soil is carried away by the running water.

The first strip is  $10 \times 70 \text{m}^2$  which a stream is traversing (Fig. 4-1, 4-2). There are 36 trees over 10cm in diameter, 18 trees from 5cm to 10cm in diameter, 89 palms, numerous herbs and 8 lianas. The 12 families and 17 genera of tall trees over three meters high were classified, a genus which belongs to Rosaceae could not be determined, and the families of two trees could not be determined (Table 6).

In this forest the trees do not form any stratum (Fig. 4-1).

The roof of the typical rain forest on high "terra firme" has not space, but on the low "terra firme" the roof of the forest has much space. Therefore the sun shines on the ground or on the trunks of trees for a few hours each day. The numerous ground herbs and epiphytes grow under this sunny and damp condition.

The herbaceous community consists of Hymenophyllaceae, Polypodiaceae, Lycopodiaceae, Bromeliaceae, Maranthaceae, Rapateaceae (*Rapatea ulei*, *R. paludosa*, *Saxofridericia subcordata*), Orchidaceae. The figures of the herbs are too many to draw on Fig. 4-1.

The second strip is  $10 \times 70 \text{m}^2$  which is crossed by a stream and included four inclined  $10 \times 10 \text{m}$  squares (Fig. 5-1, 5-2). The angle of inclination is 6 degrees (Fig. 5-2). There are 31 trees over 10cm in diameter, 39 palms (except seedlings), numerous herbs and 10 lianas.

Small trees or shrubs between 1cm and 10cm in diameter are 229 which are distributed as the following table shows.



Fig. 4.

1.



2.

Fig. 4-1. The profile figure of the primary tropical rain forest on the low "terra firme" ( $10 \times 70 \text{ m}^2$ ). This strip crosses a stream. I: stream, L: mud, Bu: *Mauritia flexuosa*, A: *Euterpe oleracea*, P: *Oenocarpus batua*.  
 Fig. 4-2. The plan figure of Fig. 4-1.

Family name	Species	Number of trees
Moraceae	<i>Brosimum paraense</i>	17.
"	<i>Pourouma myrmecophila</i>	10, 22.
Myristicaceae	<i>Virola venosa</i>	33.
Lauraceae	<i>Aniba rosmanniana</i>	28.
"	<i>Ocotea barcellensis</i>	41.
"	<i>O. fragrantissima</i>	20.
"	<i>Pleurothryum macranthum</i>	29.
Rosaceae	?	5.
Leguminosae	<i>Pithecolobium</i> sp.	1, 3.
"	<i>Taralea oppositifolia</i>	23.
Burseraceae	<i>Protium</i> sp.	6, 9, 13, 16, 19, 25, 26, 34, 35, 36, 39, 44, 46.
Meliaceae	<i>Carapa guianensis</i>	11, 14, 18, 43.
Bombacaceae	<i>Catostemma micranthum</i>	7, 24.
Ochnaceae	<i>Ouratea castaneaefolia</i>	42.
Guttiferae	<i>Vismia</i> sp.	4, 21, 27, 32, 45.
"	<i>Symphonia globulifera</i>	48.
Lecythidaceae	<i>Couratari guianensis</i>	15.
"	<i>Eschweilera matamata</i>	8, 31.
"	<i>Eschweilera</i> sp.	37, 38, 40.
Sapotaceae	<i>Lucuma</i> sp.	47.
Palmaceae	<i>Oenocarpus batua</i>	30.
?	?	2, 12.

Table 6. The constituent trees on the first strip of the low "terra firme". The numbers of trees on this table agree with the numbers of Fig. 4-1 and Fig. 4-2.

Square number	1	2	3	4	5	6	7
Number of trees	63	43	5	6	27	42	43

The squares No. 3 and No. 4 are swampy, the other squares are somewhat dry, and the squares No. 1, 2, 6 and 7 are inclined. Many seedlings of palms could be found on the square No. 7, i. e. 118 seedlings in  $1 \times 1 \text{ m}^2$ . But in the other squares they could not be found so often.

The 16 families and 21 genera of trees on the second strip were classified. Four trees over 10 cm in diameter could not be classified (Table 7). The construction of the forest on the second strip is the same as the first strip on the low "terra firme".

The vegetation of ground herbs and epiphytes is also like that of the first strip, because the several bundles of Cyperaceae exist on the second strip.

The third strip on the low "terra firme" is  $10 \times 80 \text{ m}^2$  which lie along the bottom of the ravine. There are 45 trees over 10 cm in diameter, 54 small trees or shrubs, 48 palms, numerous herbs and 16 lianas (Fig. 6-1, 6-2).

The 17 families and 28 genera could be classified, but 8 trees were undetermined (Table 8). There are many trees of about 10 m high. The sunlight is interrupted by the low trees and the many palms, and does not reach directly to



Fig. 5.

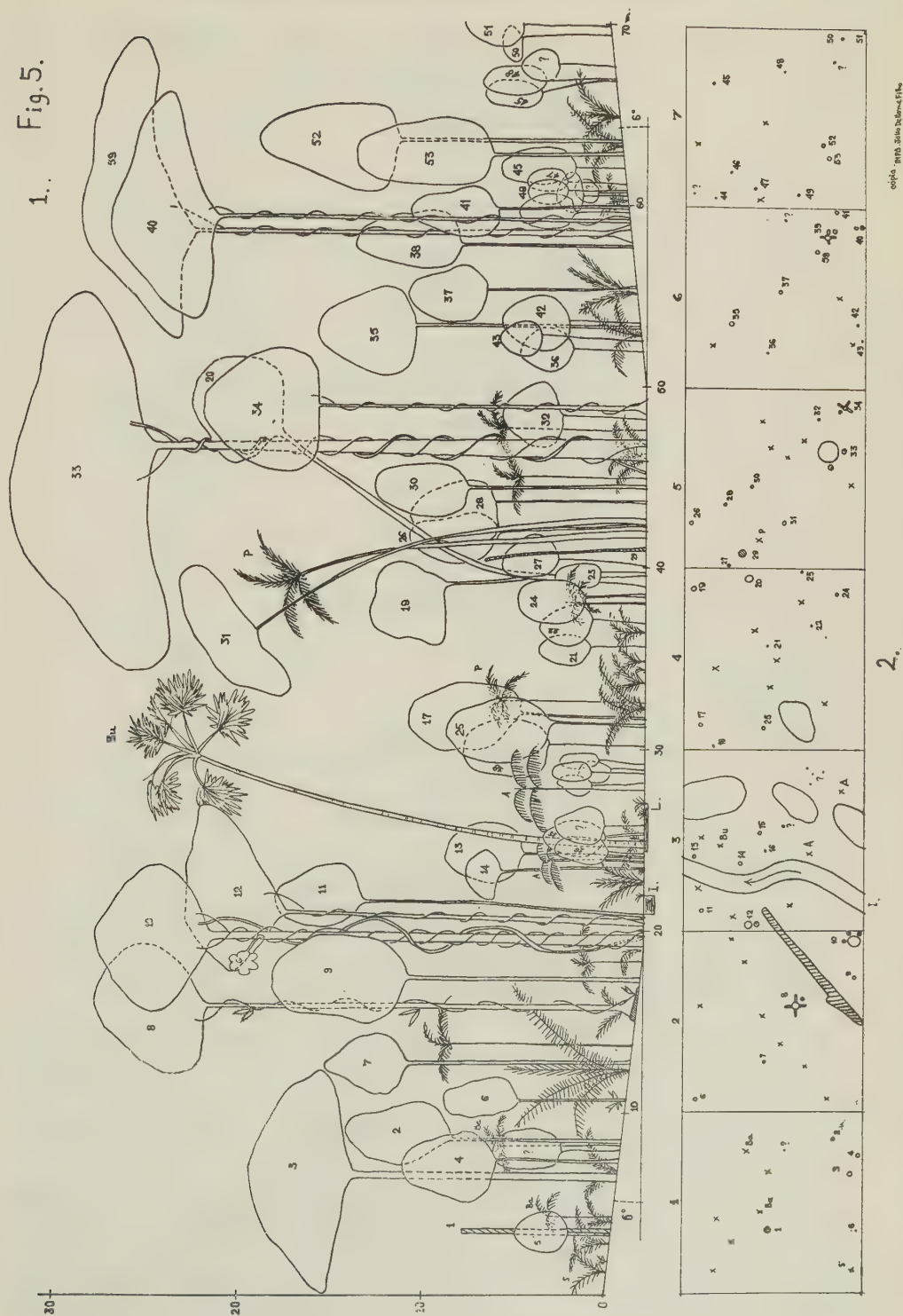


Fig. 5-1 The profile figure of the primary tropical rain forest on the low "terra firme". This strip crosses a stream.

I: stream, L: mud, B: *Mauritia flexuosa*, P: *Oenocarpus batua*, Ba: *Oenocarpus distichus*. Fig. 5-2. The plan figure of Fig. 5-1.

Family name	Species Name	Number of trees
Moraceae	<i>Brosimum paraense</i>	11.
Anonaceae	<i>Guatteria</i> sp.	32.
"	<i>Xylopia amazonica</i>	8, 17.
"	?	51.
Myristicaceae	<i>Virola venosa</i>	27.
Lauraceae	<i>Ocotea ragrantissima</i>	6, 15, 23, 46.
Rosaceae	?	3, 50.
Leguminosae	<i>Aldina heterophylla</i>	30, 40.
"	<i>Peltogyne paniculata</i>	35.
"	<i>Pithecolobium</i> sp.	20.
"	<i>Swartzia platygyn</i>	39.
"	"	5, 48.
Linaceae	?	16, 21, 22.
Euphorbiaceae	<i>Hevea brasiliensis</i>	12.
"	?	43.
Bombacaceae	<i>Catostemma micranthum</i>	36.
"	<i>Scleronema micranthum</i>	33.
Guttiferae	<i>Symphonia globulifera</i>	14.
"	<i>Vismia</i> sp.	24, 28.
Lecythidaceae	<i>Eschweilera matamata</i>	7, 26, 49.
"	<i>Eschweilera</i> sp.	4.
Combretaceae	<i>Terminalia tanibouca</i>	10, 19.
Melastomataceae	?	34.
Myrsinaceae	?	37.
Sapotaceae	<i>Chrysophyllum cyanogenum</i>	2.
"	<i>Ecclinusa spuria</i>	47.
"	<i>Pouteria cyrtobotrya</i>	42, 45.
"	<i>Sideroxylum resiniferum</i>	9.
"	?	13, 31, 38.
Apocynaceae	<i>Couma macrocarpa</i>	18.
"	?	44.
?	?	25, 41, 52, 53.

Table 7. The constituent trees on the second strip of the low "terra firme". The numbers of trees on this table agree with the numbers of Fig. 5-1 and Fig. 5-2.

to the most part of the ground, so the ground herbs are few, but the epiphytes and the herbs which grow on the sunny places, especially on the sunny trunks of trees, are numerous (Fig. 6-1, 6-2).

The relation between number and species of palms on the low "terra firme" is shown on the following table:

This table shows that a great many cauline palms which consist of *Oneocarpus batua*, *Oen. bacaba*, *Euterpe oleracea*, *Mauritia flexuosa* and *Iriarteia exorrhiza* can be found there (35% of all palms). The composition of the plams differs from that of the high "terra firme". Acauline palms which mostly consist of *Astrocaryum* sp. and *Attalea* sp. are also very many, 59% of all palms. The distribu-





Fig. 6-1. The profile figure of the primary tropical rain forest on the low "terra firme" ( $10 \times 80 \text{ m}^2$ ). This strip is parallel to a ravine and is the bottom of the ravine.

A: *Euterpe oleracea*, Pax: *Iriartea exorrhiza*.

Fig. 6-2. The plan figure of Fig. 6-1.

Family name	Species name	Number of trees
Moraceae	<i>Ficus doliaria</i>	8, 10, 12.
"	<i>Pourouma myrmecophila</i>	1, 24, 26, 30, 59, 64, 65, 69, 76.
Olacaceae	<i>Minquartia guianensis</i>	16, 20.
Anonaceae	<i>Xylopia brasiliensis</i>	27, 39, 41.
Myristicaceae	<i>Virola surinamensis</i>	45.
Lauraceae	<i>Ocotea fragrantissima</i>	36, 38, 67.
Rosaceae	<i>Licania scabra</i>	17.
"	<i>L. utilis</i>	28.
Leguminosae	<i>Aldina heterophylla</i>	6, 14, 43, 54.
"	<i>Enterolobium schomburgkii</i>	58.
"	<i>Ormosia coutinhoi</i>	63.
"	<i>Pithecolobium</i> sp.	33, 37, 52.
"	<i>Sclerolobium micropetalum</i>	42, 51, 61.
"	<i>Taralea oppositifolia</i>	21.
Burseraceae	<i>Protium</i> sp.	9, 13, 15, 31, 34, 35, 66, 68.
Euphorbiaceae	<i>Alchornea cordata</i>	40, 44, 48, 50.
Anacardiaceae	<i>Anacardium gigantum</i>	2.
Ochnaceae	<i>Ouratea castaneaefolia</i>	49.
Guttiferae	<i>Symphonia grobulifera</i>	25.
"	<i>Vismia</i> sp.	3.
Lecythidaceae	<i>Eschweilera</i> sp.	56, 60, 70.
Myrtaceae	<i>Campomanesia</i> sp.	32.
Sapotaceae	<i>Ecclinusa balata</i>	22, 62, 73.
"	<i>Lucuma</i> sp.	24.
"	<i>Pouteria cyrtobotrya</i>	18.
Apocynaceae	<i>Allamanda cathartica</i>	47, 55.
"	<i>Ambelania acida</i>	74.
"	<i>Aspidosperma album</i>	19, 72.
Bignoniaceae	<i>Cybitax antisiphilitica</i>	4.
?	?	5, 7, 23, 46, 53, 57, 71, 75.

Table 8. The constituent trees on the third strip of the low "terra firme". The numbers of trees on this table agree with the numbers of Fig. 6-1 and Fig. 6-2.

Number of strips	1	2	3	Total
Species Name				
<i>Oenocarpus batua</i>	35	8	1	44
" <i>bacaba</i>	0	3	0	3
" <i>distichus</i>	0	2	8	10
<i>Astrocaryum</i> sp.	43	23	19	85
<i>Attalea</i> sp.	8	0	11	19
<i>Euterpe oleracea</i>	2	2	6	10
<i>Mauritia flexuosa</i>	1	1	0	2
<i>Guilielma microcarpa</i>	0	0	1	1
<i>Iriarteia exorrhiza</i>	0	0	2	2
Total	89	39	48	176

Table 9. The relation between the species and the number of palms on the three strips on the low "terra firme".

tion of the palms on the low "terra firme" is like that of the high "terra firme".

On  $10 \times 220 \text{ m}^2$  there are 112 trees over 10 cm in diameter, 301 shrubs or small trees, 176 palms and numerous epiphytes and saprophytes (Diagram 1-2).

I classified 20 families and 43 genera, but 8 genera belonging to known families and 14 trees could not be classified.

The dominant group consists of Leguminosae (22 trees), Sapotaceae (14 trees) and Moraceae (13 trees). They form 44.6% of the trees over 10 cm in diameter.

The relation between height, diameter and number of trees is arranged as a dispersal table like Table 4 (Table 10).

The relation between height and diameter is shown as a linear diagram (Diagram 3-2). This diagram has three tendencies, and they can be expressed by the formula  $y=ax$ .....(1),  $y=ax+b$ .....(2) and  $y=b$ .....(3).

Height (m.)	1-5	6-10	11-15	16-20	21-25	26-30	31-35	Total	Mean	s.	c.
Diameter (cm.)											
6-10	8	43	7	1				59	8.0	1.56	0.17
11-15		15	20	3				38	11.9	1.15	0.09
16-20		1	10	10	1			22	15.5	2.52	0.16
21-25			3	6				9	16.4	0.33	0.02
26-30			1	7	4			12	19.2	1.68	0.08
31-35				2	2	1		5	22.0	3.00	0.13
36-40				3		1		4	20.5	5.00	0.24
41-45					2	1		3	24.6	2.88	0.11
46-50				1	1			2	21.5	3.54	0.16
51-55						1		1	28.0	0	0
56-60								0	0	0	0
61-65								0	0	0	0
66-70						1		1	28.0	0	0
71-75							1	1	33.0	0	0
123							1	1	33.0	0	0
154							1	1	33.0	0	0
Total	8	59	41	33	10	5	3	160	—	—	—

Table 10. Dispersal table of the relation between height, diameter and number of trees on the low "terra firme" ( $10 \times 220 \text{ m}^2$ ).

Total: total number of trees, s: standard deviation, c: coefficient of variation.

The tendency (1) is the same as (1) of Diagram 3-1. Tendency (3) is the same as that of the high "terra firme" and begins from a large diameter than (3) of the high "terra firme". It means that on the low "terra firme" the trees have hardly the large height, even have rather large diameter. On the contrary, on the high "terra firme" the trees become tall easily even if the trees do not have so large a diameter.

The relation between number and diameter of trees can not be shown as a hyperbola as that of the "terra firme". The curve descends more rapidly than the hyperbola (Diagram 4-3). Therefore it means that the trees which have a



large diameter are very few on the low "terra firme".

The relation between the number of trees over 10 cm in diameter and the height of trees is like a normal curve (Diagram 5-2).

Therefore, if the trees become over 10 cm in diameter, the height of trees increases very easily. This is very different point as compared with the trees on the high "terra firme".

The largest tree in diameter is *Scleronema micranthum* and has 123 cm in diameter (Fig. 5, No. 33). The tallest tree is also *Scleronema micranthum* or *Castostemma micrathum* (Fig. 4, No. 7) and both trees are over 30 m high. On the high "terra firme", the tallest tree is a member of Rosaceae or Leguminosae; on the contrary, on the low "terra firme" a member of Bambacaceae takes the place of Rosaceae or Leguminosae.

The trees which have large buttresses are *Pourouma myrmecophila* (Fig. 6, No. 30, 59), *Pouteria cyrtobotrya* (Fig. 6, No. 18), *Protium* sp. (Fig. 4, No. 13, 26 & 34), *Xylopia amazonica* (Fig. 5, No. 8) and undetermined species (Fig. 6, No. 41 & 75). The data of buttresses are as follows.

	a (cm.)	b (cm.)	c (cm.)	c/a	b/a	No. of Fig.	
<i>Protium</i> sp.	132	50	30	0.23	0.38	Fig. 4,	No. 34
"	160	50	17	0.16	0.31	" ,	" 13
"	200	140	12	0.06	0.70	" ,	" 26
<i>Xylopia amazonica</i>	196	65	33	0.17	0.33	Fig. 5,	No. 8
<i>Pouteria cyrtobotrya</i>	92	50	30	0.33	0.54	Fig. 6,	No. 18
<i>Pourouma myrmecophila</i>	200	80	18	0.09	0.40	" ,	" 59
"	280	80	28	0.10	0.29	" ,	" 30
?	100	40	22	0.22	0.40	" ,	" 75
?	340	200	30	0.09	0.59	" ,	" 41
Total				1.45	3.94		
Mean				0.16	0.43		
Standard deviation				0.08	0.14		
Coefficient of variation				0.50	0.32		

a : sum of basal length of two largest buttresses, b : height of the tallest buttress,  
c : diameter at the upper end of the tallest buttress.

Table 11. The result of the measurement of the buttresses on the low "terra firme".

This table shows that both values of c/a and b/a are not always definite on the low "terra firme", i. e. mean value of c/a is  $0.16 \pm 0.08$ , coefficient of variation is 0.50; mean value of b/a is  $0.43 \pm 0.14$  and coefficient of variation is 0.32.

But both mean values are very small. This means that the basal lengths of the buttreeses are large as compared with the diameters or heights of the trees. Of course the large base of buttress depend on the specific character of species, and the strong erosion which carries away most surface soil is also an important cause for it on the low "terra firme". On the same causality, many adventitious

roots on the ground can be found on the low "terra firme". According to Richards, P. W., stilt roots are stout, woody, adventitious roots which spring out from the main trunk at intervals up to 1 m or more from the ground, bend downwards, often in a graceful curve and enter the soil. But it is very difficult to distinguish the stilt roots from the normal adventitious roots on the low "terra firme". I observed typical stilt roots of the *Pourouma myrmecophila* (Moraceae, Fig. 6, No. 30, 59 & 69), *Symphonia globulifera* (Guttiferae, Fig. 6, No. 25) and *Iriartea exorrhiza* (Palmae Fig. 6, Pax.).

The normal adventitious roots which are exposed to erosion can be found on the *Ocotea fragrantissima* and many other species.

### Inclined "terra firme"

I observed also inclined "terra firme" which lies between the high "terra firme" and the low "terra firme", and has both the character of the forest on the high "terra firme" and the low "terra firme". There are few tall trees which belong to the A stratum (roof of typical rain forest), but the trees of B stratum are many. Of course, near the high "terra firme" the structure of the forest is like that of the high "terra firme" and near the low "terra firme" it is like that of the low "terra firme". I sampled  $10 \times 40 \text{ m}^2$  along the perpendicular line to a ravine.

Diagram 2-2, the relation between height, diameter and number of species and number of  $10 \times 10 \text{ m}$  quadrats are enough to investigate.

The constituent of the forest is shown in table 12. The structure of the forest is also shown in Fig. 7-1, 7-2. The dominant group is *Protium* sp. (Burseraceae) being 35 % of all trees. There are 26 trees, 173 small trees or shrubs 23 palms, 2 lianas and many herbs. The 11 families and 13 genera can be classified as Table 12.

Family Name	Species Name	Number of Trees
Moraceae	<i>Pourouma myrmecophila</i>	2.
Anonaceae	<i>Xylopia brasiliensis</i>	2.
Lauraceae	<i>Aniba rosmanniana</i>	17, 23, 24.
"	<i>Ocotea fragrantissima</i>	6.
Leguminosae	<i>Aldina heterophylla</i>	5.
"	<i>Aldina</i> sp.	7, 29.
"	<i>Vatairea seriacea</i>	26.
Linnaceae	?	13.
Burseraceae	<i>Protium</i> sp.	3, 12, 16, 21, 25, 27, 28, 31.
Sapindaceae	<i>Talisia</i> sp.	14.
Bombacaceae	<i>Catostemma micranthum</i>	4.
Sterculiaceae	<i>Teobroma spurceum</i>	8.
Lecythidaceae	<i>Eschweilera</i> sp.	9, 10, 11, 18, 30.
Sapotaceae	<i>Lucuma</i> sp.	20.
"	?	1.

Table 12. The constituent trees on the  $10 \times 40 \text{ m}^2$  inclined "terra firme". The numbers of trees on this table agree with the numbers of Fig. 7-1 and Fig. 7-2.

The relation between height, diameter and number of trees is shown and a dispersal table (Table 13). The relation between diameter and number of trees does not show the hyperbola (on the high "terra firme") and the curve like the low "terra firme" (Diagram 4-4). This diagram shows that the forest on the inclined "terra firme" consists of the trees having median diameter. The relation between height and number of trees is shown in Diagram 5-3. This diagram shows the intermediate character between the high "terra firme" and the low "terra firme". Therefore, most of the forest on the inclined "terra firme" consists of the trees which have median height and diameter, in fact the roof of the

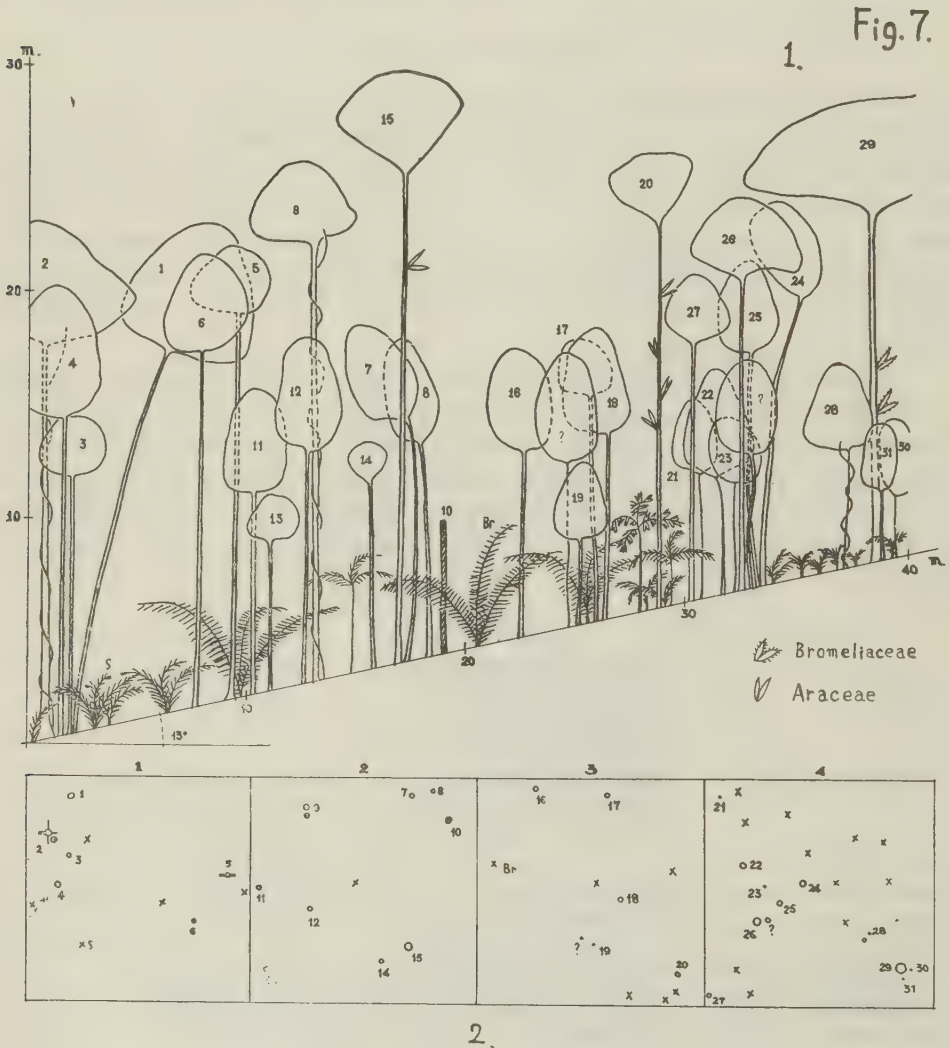


Fig. 7-1. The profile figure of the primary tropical rain forest on the inclined "terra firme" (10×40m²). Br: *Attalea* sp. s: *Astrocaryum* sp. Fig. 7-2. The plan figure of Fig. 7-1.



forest consists of those trees (Fig. 7-1, 7-2).

The relation between height and diameter of trees on the inclined "terra firme" is like that of the low "terra firme", except a little difference (Diagram 3-3).

Height (m.)	6-10	11-15	16-20	21-25	Total	Mean	s.	c.
Diameter (cm.)								
6-10	6	3			9	9.6	1.36	0.14
11-15	3	4	1		8	11.0	2.96	0.26
16-20		4	1		5	14.0	2.06	0.14
21-25	1	1	3		5	15.0	3.94	0.26
26-30				1	1	23.0	0	0
31-35					0	0	0	0
36-40			1	1	2	20.5	3.52	0.17
41-45			1		1	18.0	0	0
Total	10	12	7	2	31	—	—	—

Table 13. Dispersal table of the relation between height, diameter and number of trees on the inclined "terra firme" ( $10 \times 40 \text{ m}^2$ ). Total: total number of trees, S: standard deviation, C: coefficient of variation.

### Summary

In this report, I tried to express the structure of the Amazonian tropical rain forest with several diagrams, tables and figures.

They show that the structure of the rain forest can be changed by the only on topographic condition, although it gives many effects to the other conditions.

The dominant species among the tall trees on the high "terra firme" belong to Leguminosae, Lecythidaceae and Sapotaceae. On the low "terra firme" they belong to Leguminosae, Sapotaceae and Moraceae, and on the inclined "terra firme" they belong to Burseraceae.

The trees on the high "terra firme" are formed by three strata, but on the low "terra firme" no stratum is formed.

The species number of herbs on the low "terra firme", particularly the number of epiphytes, is more than that of the high "terra firme" and inclined "terra firme".

A great many cauline palms are found among acauline palms on the low "terra firme" but they are few on the high "terra firme".

I wish to express my gratitude to Dr. Tito Arcoverde, Director of the Instituto Nacional de Pesquisas da Amazônia and Dr. Raul Amorim Antony, sub-director of the same Institute for their kind aid to this work.

25, June, 1959.

### Literature cited

- Carpenter, J. Richard, 1938: An ecological glossary, London IX, 306 pp.  
 Croizat, Léon, 1952: Manual of phytogeography. Hague. VIII, 558 pp.

- Dansereau, Pierre, 1957: Biogeography; an ecological perspective. New York. 394 pp.
- Daubehmire, Rexford F., 1950: Plants and Environment. New York. 424 pp.
- Oosting, Hehry J., 1956: The study of plant communities; an introduction to plant ecology. San Francisco. 440 pp.
- Paul le Cointe, 1947: Árvores e plantas úteis. 2 ed. Brazil. 506 pp.
- Richards, P. W., 1952: The tropical rain forest; an ecological study. London 450 pp.

# The Structure of the Amazonian Vegetation

## III. *Campina* Forest in the Rio Negro Region

By

Masayuki TAKEUCHI\*

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With one Figure, 4 Diagrams and 4 Tables in the Text and 4 Plates

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### Introduction

Dansereau, P. (1957) said that the north-eastern Brazilian *caatinga* (white forest in Indian language) is one of the typical thorn forests where the dry period is longer than that of active vegetation. He also described about this forest that the trees, usually low, very smooth-barked, are deciduous; there are also many succulents, some of very tall, and ephemeral but luxuriant growth of annuals.

According to Carpenter's Ecological Glossary (1956), the *caatinga* is the Brazilian forest which is deciduous during the hot dry season.

In the Rio Negro region, the forests called *caatingas* are scattered among the tropical rain forests on the *terra firme*. Richards, P. W. (1952) pointed out that the *caatingas* of the Rio Negro are not to be confused with south Brazilian *caatingas* which are deciduous forests. Because the forest called *caatinga* in the Rio Negro is a ever green forest.

On the other hand, the character of the soil is very different between the *caatinga* of the Rio Negro and of the northeastern Brazil.

For instance, the soil of the *caatinga* in the Rio Negro consists of bleached sand, and in the northeastern Brazil the soil has a tendency to hardening at the surface.

By the above mentioned difference, I suggest that the *campina* forest is the

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better name than the *caatinga* to the forest which has been called the *caatinga* of the lower Rio Negro. The term *campina* means the grassland or the dwarf forest on the bleached sand.

The investigated place is situated on 29 km north-north-west of Manaus city which is the capital of Amazonas State in Brazil.

The way of Manaus-Claracari crosses the investigated *campina* (Pl. 1). We can observe the soil structure of the *campina* at the cut of way (Pl. 3, the upper)

The soil consists of 1-2 cm humus layer at the surface and 1.5-2 m layer of bleached and coarse sand under the surface layer. The roots of the plants can be found in the humus and the bleached sand which is 30 cm in depth (Pl. 3, the upper).

The investigated place belongs to Köppen's Am climatic zone, so that the dry period is not long. The permeability of water in the sand of the *campina* is very high, so that the most organic substances are carried away into the deep ground by rainy water and the dryness is very strong. These conditions cause that the most roots can not reach to the ground more than 30 cm in depth.

In the *campina*, the maximum temperature is 32°C and the minimum temperature is 22°C at the shadow, on 24 th of September in 1959, the day in the dry period.

For this investigation, I marked a narrow sample strip of forest with 5 m scale as serial 5×5 m<sup>2</sup>.

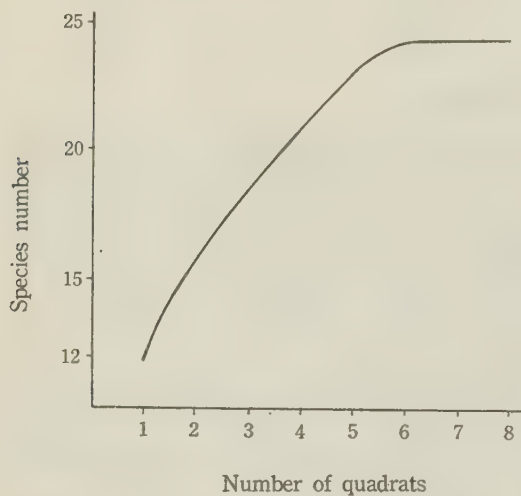


Diagram 1. The curve shows the increase of the species number of trees and shrubs.

The increase of the species number of trees and shrubs is shown by Diagram 1. It suggests that we must observe at least seven or eight 5×5 m<sup>2</sup> quadrats in the *campina*.

The diameter of trees, the extension of adventitious roots when exist and the positions of trees, palms and lianas are mapped on the plan of rectangular strips.

The total height, the height of the crown, the height of the first large branching, the form of the crown, the width of the crown, the height of the adventitious roots and the form of each tree are measured and recorded, and mapped on the elevation (Fig. 1). The statistic tables and diagrams were made as the results of the measurements.

### The structure of the forest

The *campina* forest consists of the trees to be in three strata, i. e. under growth, lianas and epiphytes.



Fig. 1. The profile and plane figures of the *campina* forest on the sample strip of  $5 \times 40 \text{ m}^2$ . These figures show the structure of the *campina* forest.

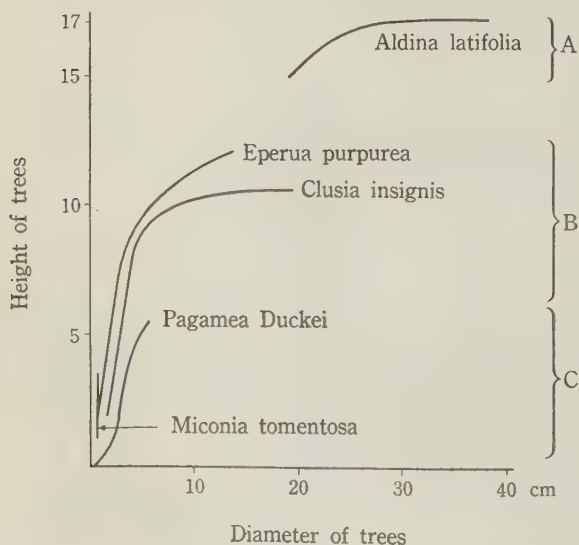
B: Bromeliaceae, A: Araceae, O: Orchidaceae, X: Palmaceae, +: adventitious root, dotted lines: direction of stretch of lianas.

Nos. 36, 54, 87, 89 & 98 are *Aldina latifolia*. Nos. 24, 26, 27, 28, 29, 30, 43, 44, 63, 64, 73, 74, 76, 77, 78, 82, 85, 93, 94, 96, 97 & 99 are *Clusia insignis*. Nos. 6, 8, 21, 37, 38, 42, 51 & 55 are *Anona* sp. Nos. 10, 17, 23, 88 & 90 are *Eperua purpurea*. Nos. 7, 65 (right) & 79 are *Aniba hostmanniana*. Nos. 25, 32 & 62 are *Heisteria guianensis*. Nos. 9 & 12 are *Talisia esculenta*. No. 39 is *Macrolobium arenarium*. Nos. 1, 2, 3, 4, 5, 11, 13, 14, 15, 16, 18, 20, 22, 31, 33, 40, 41, 45, 46, 48, 49, 52, 53, 56, 57, 58, 59, 60, 65 (left), 66, 67, 68, 69, 70, 71, 72, 75, 80, 81, 83, 84, 86, 91, 92, 95 & 100 are *Pagamea Duckei*. Nos. 34, 35, 47, 50 & 61 are *Miconia tomentosa*. No. 19 is a dead tree.

A-stratum of the *campina*, the roof of the forest, consists of only one species, *Aldina latifolia* Benth. (Leguminosae). The forest is characterized by this species which is 15–17 m in height and 19–48 cm in diameter. Its branches at a height of more than 3 m and the wide branches stretch the diameter of about 16 m (Fig. 1–36, 54, 87 & 89). The coverage of this species is very large, almost 100%. On the other hand, the frequency of this species is very small,  $0.02/\text{m}^2$ .

The leaves of the tree do not grow luxuriantly as the profile figure (Fig. 1 & Pl. 1, the upper) shows, so that the sunlight reaches to the lower strata, B- and C-stratum, and even to the ground in some places (Pl. 1, the lower). This rich sunlight in the forest causes the rich epiphytic vegetation on the crooked branches of *Aldina latifolia* (Pl. 4) or on the branches and the trunks of other trees (Pl. 4). Even if some epiphytes fall to the ground, they can grow successively. On the contrary, in the typical tropical rain forest they can not grow easily.

The relation between the height and the diameter of *Aldina latifolia* is shown in Diagram 2. The maximum height of the next stratum (B-stratum) is more than the height of the first branch of *Aldina latifolia*.



B-stratum: The B-stratum consists of eight species, *Clusia insignis* (Guttiferae), *Anona* sp. (Anonaceae), *Eperua purpurea* (Leguminosae), *Talisia esculenta* (Sapindaceae), *Macrolobium arenarium* (Leguminosae), *Aniba hostmanniana* (Lauraceae), *Heisteria guianensis* (Olacaceae), and *Erythrina corallodendron* (Leguminosae).

Diagram 2. The diagram shows the relation between the height and the diameter of five species.



The frequency of the above species are as follows ;

Table 1.

Species name	Common name	Number of species per 100 m <sup>2</sup>
<i>Clusia insignis</i>	—	13
<i>Anona</i> sp.	envirera	7.5
<i>Eperua purpurea</i>	copaibarana	3
<i>Talisia esculenta</i>	pitomba	2
<i>Aniba hostmanniana</i>	louro amarelo	1
<i>Heisteria guianensis</i>	—	1

*Macrobium arenarium* and *Erythrina corallodendron* are rare.

Some species belonging to B-stratum can be found in the tropical rain forest. For instance, *Clusia insignis* is not only the dominant species of the B-stratum in the *campina*, but also it can be found in the tropical rain forest.

In the *campina*, *Clusia insignis* is only 20 cm in the maximum diameter and 11 m in the maximum height. On the other hand, in the tropical rain forest near the *campina* the same species is higher and has larger diameter, 45–50 cm. This species has remarkable adventitious roots (Pl. 2 & Fig. 1).

The trees of the B-stratum have large and broad leaves (mesophylls or macorphylls), except *Heisteria guianensis* (Olacaceae) which has small leaves (microphylls). The leaves of the trees occur on the upper parts of the trees, therefore the trees show cones or short conical forms with long handles.

The relations between the heights and the diameters of *Eperua purpurea* and *Clusia insignis* are shown in Fig. 3, and the tendency of these curves are almost the same as that of the other species of the B-stratum.

I recognized the seedling of the following species in the narrow sample strip: two *Talisia esculenta*, twenty-eight *Clusia insignis* and six *Anona* sp.

The trees belong to the B-stratum are too few to intercept the sunlight, so the next stratum, C-stratum, shows very dense community.

C-stratum: The C-stratum is bushy community. The members of this community consist of *Pagamea Duckei*, *Cinchona* sp. (Rubiaceae), *Miconia tomentosa* (Melastomaceae), *Miconia* sp. *Croton* sp. (Euphorbiaceae), *Neea oppositifolia* (Nyctaginaceae) and *Amylocarpus inermis* (Palmaceae).

Dominant species is *Pagamea Duckei* (Pl. 3 the upper). The frequency of this species is very high, 64 per 100 m<sup>2</sup>. Very young plants including the seedling are seventy-three in the sample strip. The relations between the height, diameter and number of the species are shown in the following table.

Table 2. The relation between the height, the diameter and the number of *Pagamea Duckei*.

Height (m)	0.1-1	1.1-2	2.1-3	3.1-4	4.1-5	5.1-6	6.1-7	Total	M.	S. (±)	C. (±)
Diameter (cm)											
0.1-1	73							73	0.5	0	0
1.1-2		12	11	2	1			26	2.15	0.57	0.26
2.1-3			4	3	2	1		10	3.7	0.87	0.21

3.1-4	1	5	1	1		8	3.75	0.88	0.23
4.1-5	1		3	3	1	8	4.62	1.12	0.25
5.1-6			1	1	1	3	5.5	1.00	0.18
Total.	73	12	17	10	8	6	2	128	

M: mean, S: standard deviation, C: coefficient of variation

The relations between the height and the diameter of *Pagamea Duckei* and *Miconia tomentosa* are shown in Diagram 2. These curves are almost perpendicular, which represent the character of the C-stratum. The frequency of *Miconia tomentosa* is 2.5 per 100 m<sup>2</sup> and those of *Cinchona* sp., *Miconia* sp., *Croton* sp. and *Neea oppositifolia* are very little. The frequency of *Amylocarpus inermis* is 11 per 100 m<sup>2</sup>. This species has been often considered as genus *Geonoma* by mistake, because of the difficulty to get the flower. I fortunately got its complete flower. The seedlings of this palm are also seen in the *campina*.

The community of the C-stratum shown the compact bush. If the B-stratum existed in other locality, and had less frequency, the C-stratum would become the more compact bush, where anybody can not enter.

Undergrowth: The undergrowth consists of seedlings of trees, small shrubs and herbs. I already mentioned about the seedlings of trees in each case.

The community of the small shrubs consists of *Psychotria melaneoides* var. *barbiflora* (Rubiaceae), *Mabea occidentalis* var. *gemina*, *M. occidentalis* var. *concolor* (Euphorbiaceae) and *Vernonia* sp. (Compositae).

Dominant species of this community is *Psychotria melaneoides* var. *barbiflora* which has the frequency of 30 per 100 m<sup>2</sup>. This species is 20-30 cm in height and the stretched branches are 40-50 cm in diameter.

The coverage of this species is about 5.88 % in the sample strip. *Mabea occidentalis* including two varieties has the frequency of 8 per 100 m<sup>2</sup> and the coverage of about 2.5 %. *Vernonia* sp. was not found in the sample strip, but in a more open place where some trees died it forms a dense bush.

The community of the herbs is classified into terrestrial herbs and epiphytes. The terrestrial herbs, the undergrowth-herbs, consist of the species in the following table.

Table 3. The members of the undergrowth herbs.

Species name	Family name	Note and frequency
<i>Amblyanthera fluminensis</i>	Apocynaceae	climbing
?	Asclepiadaceae	"
<i>Ipomoea</i> sp.	Convolvulaceae	"
<i>Dioscorea</i> sp.	Dioscoreaceae	"
<i>Smilax papyracea</i>	Smilacaceae	"
<i>Calathea</i> sp.	Marantaceae	0.19/m <sup>2</sup>
<i>Aechmea setigera</i>	Bromeliaceae	0.01/m <sup>2</sup>
<i>Streptocalyx</i> sp.	"	"
<i>Anthurium</i> sp.	Araceae	"
<i>Philodendron</i> sp.	"	0.06/m <sup>2</sup>

<i>Spiranthus</i> sp.	Orchidaceae	
<i>Epidendrum</i> sp.	"	sunlit place
<i>Paepalanthus</i> sp.	Eriocaulaceae	"
<i>Panicum</i> sp.	Gramineae	0.14/m <sup>2</sup>
?	Cyperaceae	0.30/m <sup>2</sup>
<i>Selaginella</i> sp.	Selaginellaceae	

The dominant species consist of one of Cyperaceae, *Panicum* sp. and *Calathea* sp., which have the coverage of 0.30/m<sup>2</sup>, 0.14/m<sup>2</sup> and 0.19/m<sup>2</sup> respectively.

Two of Bromeliaceae have large local coverage, and they form pure groups (Pl. 2 & 3 the upper). *Epidendrum* sp. and *Paepalanthus* sp. grow only sunlit places. If the shrubs are not many and the sun shines a little more, the undergrowth shows the more crowded community than on the shade. A species of lichen, *Cladonia* sp., can be found such sunlit places (Pl. 2, the middle). When humidity is high, *Cladonia* sp. becomes like sponge.

If the coverage of bushes or small trees is very large, the coverage of undergrowths becomes very small.

Epiphytes: The community of the epiphytes consists of Bromeliaceae, Araceae, Orchidaceae, Cactaceae, Polypodiaceae, Hymenophyllaceae, mosses and lichens. The branches and trunks of trees, especially *Aldina latifolia*, are covered with the epiphytes (Pl. 4). The individual number of the epiphytes is numerous.

Table 4. The member of the vascular epiphytes.

Bromeliaceae	(B: in Fig. 1)
<i>Aechmea mertensii</i>	
<i>Aechmea</i> sp.	
Araceae	(A: in Fig. 1)
<i>Anthurium panduratum</i>	
<i>Anthurium bredemeyeri</i>	
<i>Philodendron</i> sp.	
Orchidaceae	(O: in Fig. 1)
<i>Scuticaria stelii</i>	
<i>Octomeria decumbens</i>	
<i>Octomeria</i> sp.	
<i>Pleurothallis linearifolia</i>	
<i>Cattleya purpurea</i>	
<i>Cattleya alba</i>	
<i>Stenocoryne</i> sp.	
<i>Rodriguezia</i> sp.	
<i>Maxillaria amazonica</i>	
<i>Maxillaria tarmanensis</i>	
<i>Camaridium imbricatum</i>	
Cactaceae	
<i>Rhipsalis</i> sp.	
Polypodiaceae	
<i>Elaphoglossum squamosum</i>	



*Elaphoglossum* sp.  
*Polypodium trichomanoides*  
 Hymenophyllaceae  
*Hymenophyllum ciliatum*

*Aechmea* has the broad stiff leaves and large leafsheaths, and it is called tank epiphyte (Pl. 3, the upper). Four species of Araceae have rhizomes which can reserve much water, and have rather succulent leaves and petioles. Thirteen species of Orchidaceae have succulent leaves, pseudobulbs and rhizomes, e.g. *Scuticaria stelii* (Pl. 4, the upper) and *Octomeria* sp. have cylindrical succulent leaves. *Cattleya* sp. and *Rodoriguezia* sp. have the pseudobulbs. *Elaphoglossum squamosum* and *Elaphoglossum* sp. of Polypodiaceae are covered with many dense hairs. *Polypodium trichomanoides* of Polypodiaceae and *Hymenophyllum ciliatum* (Pl. 2, the middle) of Hymenophyllaceae are small and thin ferns. They grow among the epiphytic mosses reserving the rain water.

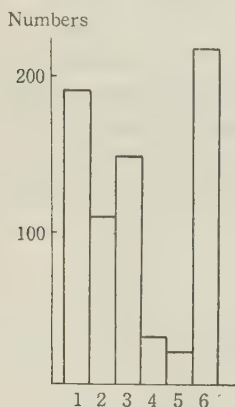


Diagram 3. The diagram shows the composition of the campina forest. 1: trees, 2: shrubs, 3: undergrowth herbs, 4: lianas, 5: palms, 6: epiphytes.

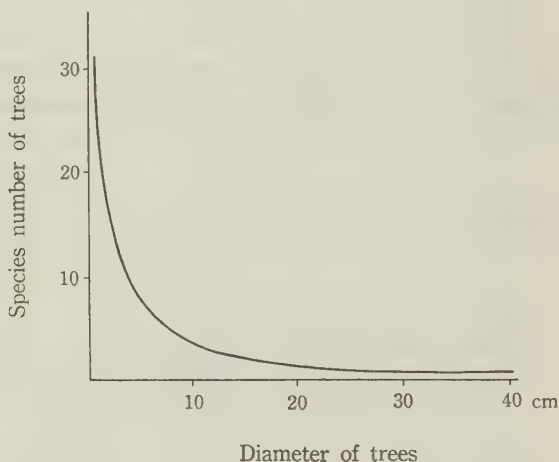


Diagram 4. The relation between the number and the diameter of trees.

### Consideration

The *campina* forest in the Rio Negro region belongs to Köppen's Am climatic zone, the same zone as the tropical rain forest. We can find the same species in the *campina* forest and in the tropical rain forest. But the structures of two forests are very different. The roof of the tropical rain forest consists of many species (cf. II. Tropical rain forest). On the other hand, the roof of the *campina* forest consists of one species.

The light-intensity is very little in the tropical rain forest, but it is strong in the *campina* forest. So the epiphytes are a few in the former, and are a great many in the latter.

The composition of the *campina* forest is shown in Diagram 3, i.e. trees are 190, shrubs are 107, undergrowth herbs are 147, lianas are 31. Palms are 22 and epiphytes are numerous. This composition somewhat resembles that of the tropical rain forest in the low *terra firme*.

The *campina* forest in the Rio Negro differs from the *caatinga* in the other regions, as I mentioned in the introduction.

The relation between the diameter and number of trees is shown in Diagram 4. This figure shows that the larger the diameter of trees becomes, the more the number of trees decreases rapidly.

The bleached sand causes the characteristic forest in the *campina*. *Aldina latifolia* causes the characteristic appearance of the *campina* forest.

### Summary

The composition of the *campina* forest is shown in Fig. 4.

The roof of the forest (A-stratum) consists of *Aldina latifolia*.

The coverage of this species is almost 100 %, and the frequency of this species is 0.02/m<sup>2</sup>.

The B-stratum consists of eight species. The species name and the frequency of six species are shown in Table 1.

The C-stratum consists of seven species including a palm. The dominant species is *Pagamea Duckei* with frequency of 0.64/m<sup>2</sup>.

The undergrowths consist of four small shrubs and sixteen herbs (Table 3).

The dominant species of the small shrubs is *Psychotria melaneoides* var. *barbiflora* with the frequency of 0.3/m<sup>2</sup> and the coverage of 5.88 %. *Aechmea* and *Streptocalyx* form pure groups.

The community of the epiphytes consists of twenty three vascular plants, mosses and lichens.

The character of the soil which consists of bleached and coast sand causes the *campina* forest. The feature of the forest is shown in Fig. 2.

The relation between the height and the diameter of trees is shown in Fig. 3.

— November 1959 —

### Literature cited

- Carpenter, J. Richard, 1938: An Ecological Glossary. IX, 306 pp.  
Dansereau, Pierre, 1957: Biogeography. 394 pp.  
Richards, P.W., 1952: The Tropical Rain Forest. 450 pp.

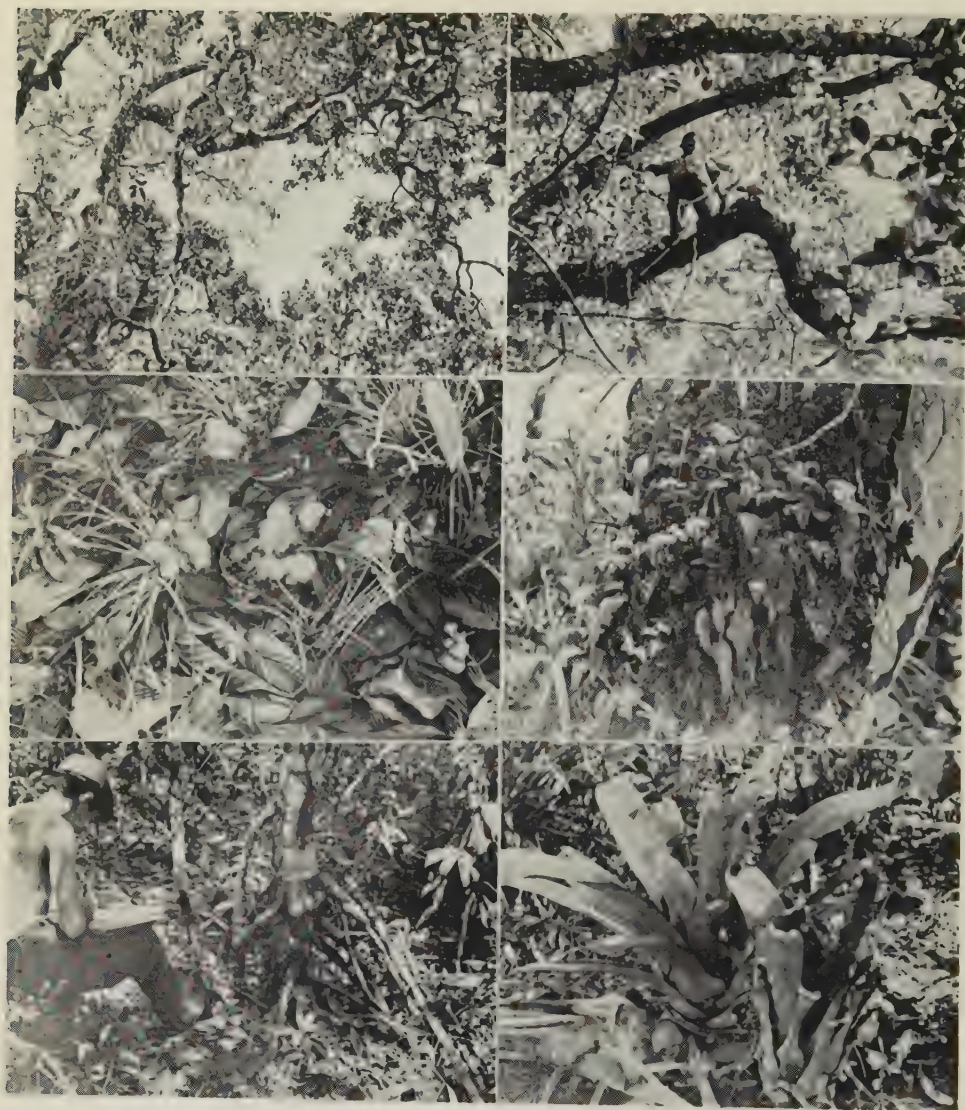




M. Takeuchi, The Structure of the Amazonian Vegetation (3)

Pl. 1 The panoramic photograph of the *campina* forest (upper). The foreground shows the bleached sand (white). The lower photographs show the sunlight spots in the *campina* forest and my two assistants.





M. Takeuchi, The Structure of The Amazonian Vegetation (3)

Pl. 2 The roof of the *campina* forest (upper, left). Crooked branches of *Aldina latifolia* (upper, right). *Cladonia* sp. on the ground (middle, left). *Hymenophyllum ciliatum* on the trunk (middle, right). Adventitious roots of *Clusia insignis* (lower, left). *Aechmea setigera* on the ground (lower, right).



M. Takeuchi, The Structure of The Amazonian Vegetation (3)

Pl. 3 The *campina* forest on the bleached sand (upper, left). It shows the roots appearing from the surface to 30 cm. depth at the cut along the road. The dominant species of C-stratum, *Pagamea Duckei* (upper, right). *Streptocalyx* sp. on the ground (lower, left). *Aechmea* sp. on the trunk (lower, right).





M. Takeuchi, The Structure of the Amazonian Vegetation (3)

Pl. 4 A trunk of *Aldina latifolia* showing many epiphytes (upper, left). *Scuticaria stelii* on the trunk of *Pagamea Duckei* (upper, right). One of Araceae on the branch of *Aldina latifolia* (lower, left). Many epiphytes, orchids and lichens, on the trunk (lower, right).

# Classification of the Family Cyperaceae (1)

By

Tetsuo KOYAMA\*

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With 7 Figures

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Appendix. A bibliography of the Eastern Asiatic cyperology

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\*\* These genera together with appendix will be included in the next number of this Journal.



### Introduction and general remarks

With a large number of species and the high complexity in the floral parts, the family Cyperaceae affords us exceptionally wide taxonomic interests. Toward the close of the eighteenth century, C. B. Clarke prepared an extensive monograph of this family, only the framework of which was published after his death in the Kew Bulletin, additional series No. 8, as long ago as 1908. Though it would be impossible to give the precise number of all the cyperaceous species of the world, we estimate those known and described at 4,000 or even more. Preparation of a monograph of such a vast family, though there is an increasing need especially in recent years, can only be made on the regional bases, as has been already done in the species of eastern Asia by Ohwi (1936-44) and Akiyama (1932-55), of North America by Mackenzie, Beetle and Svenson (1935-57), of U. S. S. R. by V. Kreczetowicz and a few others (1935), or of Malaysia by Nelves and Kern (1951-60). On the other hand it seems also important to systematize the genera of the family in accordance with the recent advancement in the cyperology.

This article, consisting of two parts, has been prepared with the intention here stated. In the first part is given a phylogenetical account of the infra-familiar groups of the family with a discussion of the morphology of the cyperaceous plants. The systematic arrangement of the genera involved therein will provide a preliminary survey of the composition of the family. The second part is an annotated systematic enumeration of all species of the family known in Japan and its neighbouring regions, so that this part is actually the extension of my previous work made on the genus *Scirpus* (see Vol. 8, Part 6 of this Journal [1958]). As mentioned above, Ohwi published the same kind of work about twenty years ago, and this elaborate work has been highly evaluated as being a standard synopsis of the family in the Far Eastern part of Asia. However, with the analysis of the cyperaceous floras of Malaysia, Indo-China and the Himalayas, the need was felt to largely revise his work chiefly in the regional relationships of the species. The partial treatments made by me since about 1952 were also included in the present enumeration.

Although this enumeration gives my concept on the Far Eastern species of the Cyperaceae, it was originally prepared as a fully descriptive account with illustrations and detailed citations of the specimens examined. The manuscript in its original form proved too extensive for immediate publication.

Here it is appropriate to mention the source of materials used for carrying out this project. The herbaria of University of Tokyo, the Kyoto University and the National Science Museum in Tokyo supplied me with the main bases, and some additional specimens were checked in some other Japanese local herbaria, among which are the herbarium of the Kagoshima University for the Ryukyu flora, and that of the Hokkaido University for the flora of the northern Pacific regions. During my stay in the States, I have had opportunities to examine

many specimens kept in several large American and Canadian herbaria, while I got the loan of specimens from Kew and Paris several times. Furthermore, since 1950, by means of exchanging the cyperaceous specimens with many herbaria in Europe, Africa, Australia and Canada, I also have a considerable accumulation of good sets of foreign materials near at hand. It was quite fortunate that there happened a casual coincidence of time between my own project and the Japanese botanical expeditions to the Himalayas. For these several years, Kitamura and Hara organized the botanical expeditions to various parts of the Himalayan Range. The Cyperaceae of their collection, which were turned over me for the identification, were quite indispensable for the reexamination of many Japanese *Carices*. The following are the herbaria in which the specimens cited in this article are deposited:

- A: Arnold Arboretum of the Harvard University, Cambridge, U. S. A.
- AD: State Herbarium of South Australia, Adelaide, Australia.
- BISH: Bernice P. Bishop Museum, Honolulu, U. S. A.
- FU: Kyushu University, Fukuoka, Japan.
- GH: Gray Herbarium of the Harvard University, Cambridge, U. S. A.
- IUM: Iwate University, Morioka, Japan.
- K: Royal Botanic Gardens, Kew, England.
- KAG: Kagoshima University, Kagoshima, Japan.
- KYO: Kyoto University, Kyoto, Japan.
- L: Rijksherbarium, Leiden, Netherlands.
- MTJB: Jardin Botanique de Montréal, Montreal, Canada.
- NY: New York Botanical Garden, New York, U. S. A.
- P: Muséum national d'Histoire naturelle, Paris, France.
- SAP: Hokkaido University, Sapporo, Japan.
- TAI: National Taiwan University, Taipei, China.
- TAIF: Taiwan Forestry Research Institute, Taipei, China.
- TI: University of Tokyo, Tokyo, Japan.
- TNS: National Science Museum, Tokyo, Japan.
- UPS: Institution för Systematisk Botanik, University of Uppsala, Uppsala, Sweden.
- US: United States National Herbarium, Washington, U. S. A.

It was in 1952 that my first paper dealing with the Japanese Cyperaceae was published, but my interest in this highly technical family had already initiated at Tokyo as early as in my middle school age under the intimate guidance of Dr. Jisaburo Ohwi. Later on since I got my working place at the Department of Botany, Faculty of Science, University of Tokyo, Professor Hiroshi Hara so generously gave me every facility to carry out this project, while Dr. Ohwi so thoughtfully forwarded me many of his own notes and specimens related to the Cyperaceae. I should like to express my sincerest thanks to both of my mentors for their constant guidance ever been done, without which none of my work would have been accomplished. I am also very grateful to Dr. F. Maekawa, Dr. S. Watari and Dr. N. Tanaka, professors of our department, for their kind advices respectively phylogenetical, anatomical and cytological points of view. All chromosomal

data cited in this article are entirely depending upon the series of reports published by Dr. Tanaka since 1937.

My deep appreciations are due to the directors and the curators of the herbaria, who were so kind to send me the specimens on loan or to afford me the permission for the free use of specimens kept therein. Likewise, I am greatly indebted to such senior cyperologists as the late Mr. E. Nelses (Kew), Mr. C. G. Alm (Uppsala), Mr. M. Raymond (Montreal), Mr. J. H. Kern (Leiden), Mr. J. A. Calder (Ottawa), Dr. A. A. Beetle (Wyoming) and Dr. B. C. Stone (Washington, D. C.) for their various cooperations that gave me propelling power not a little. To Dr. E. H. Walker (Washington, D. C.), Mr. F. A. McClure (Washington, D. C.) and Dr. S. Y. Hu (Cambridge) I am grateful for other assistance. Another particular debt is owed to Miss K. Kasamatsu who so ably typed my sometimes illegible manuscript. To conclude acknowledgements, I here express my thanks to the plant collectors for their toil in gathering Cyperaceae for me by listing their names. They are: Mr. K. Mayebara (Kyushu), Mr. M. Furuse (central and northern Japan, particularly on high mountains), Mr. T. Omura (Tokai district), Mr. T. Amano (the Ryukyus), and the late Mr. A. Fujimaki (northeastern district).

## Part I. PHYLOGENETIC CLASSIFICATION OF THE CYPERACEAE

### Systematically important morphological characters

#### 1. Prophylls.

The prophylls are most frequently mentioned in treating the Cyperaceae among all the monocotyledonous families. The structure described as prophylls is a small scale-like organ of varying form, which appears either as consisting elements of spikelets or as reduced scales at the base of branches. In various cyperaceous genera, the prophylls in the current sense seem to be most conspicuous in the spikelets of *Carex*. The pistillate flowers of *Carex* are inclosed in bottle-shaped organs which are commonly called utricles or perigynia. In 1835, Kunth, interpreting the morphological structure of the pistillate spikelets of *Carex*, showed the bracteal nature of the utricle, i. e. the prophyll, which had been said to be the perianth by several authors until then. Recently, in taxonomy of Cyperaceae, the term prophyll is more widely used for representing any reduced scale leaves at the base of branches and the rachilla of spikelets, not being restricted to the utricles of *Carex*. Thus the tubular organ at the base of an umbel ray in *Cyperus* or *Scirpus*, the similar organ at the base of the peduncles of *Carex*, and the small inner scales included in the spikelets of the subfamily Mapanioideae are generally called prophylls.

In 1944, Blaser published an extensive morphological account of the prophylls

of the Cyperaceae. According to his conclusion in which I fully concur, the *prophylls of the Cyperaceae*\* are merely a leaf, which can be occasionaly distinguished by its apparent position and form which may be modified in various ways. However, they are of great taxonomical value in investigating the interrelationships among the groups of the Cyperaceae, since the prophylls are, as generally understood, (1) homologous within the genera, (2) differentiate rachillae from branches, and (3) exhibit various degrees of specialization in their shape and position, as is mentioned below, so that they may be used in showing the phylogenetical differentiation within the family Cyperaceae.

(1) Tubular prophylls are born at the base of branches, for example at the base of the umbel rays of *Cyperus*. They are truly cylindrical and as a rule outwardly two-veined. When the veins are prominent, they are excurrent into a pair of short awns at the truncate orifice. In *Carex*, the same type of prophyll is found at the base of peduncles of the spikelets. They tend to become thinner in the texture. When the peduncle is long and completely enclosed by the bract sheath, the prophyll is truly cylindrical, but if the peduncle is much abbreviated and bract sheath is wanting, it becomes ligulate and frequently quite veinless. This tubular prophyll also appears in the axil of the floral scales of the spikelets, from which the secondary branchlets arise, when the spikelets become viviparous. Such a condition is often found in the spikelets of *Eleocharis* section *Multicaules*.

The morphological origin of the prophyll in relation to the two parallel veins has been investigated. It has been explained that the prophyll is a fusion of two lateral prophyllar scales. Thus the two veins are the midribs of these fused scales. According to Blaser, however, the sheathing prophyll at the base of a branchlet usually has many vascular bundles of varying size, at least at its base, this being structurally the same as the usual sheathing base of the subtending bract leaf. This evidence seems to agree with the theory that the prophyll is merely a specialized leaf. In addition it may be pointed out that on the surface, the pair of veins becomes conspicuous usually above the base and not at the very base, where many short veins of various thickness are found. Furthermore, in *Cyperus* and *Scirpus*, from the prophyll there always arises only one ray. As observed by Goebel and Rüter, if the prophyll is of double origin, one would expect two branchlets. The prophylls of the Cyperaceae, therefore, will be better regarded as of a simple origin, occasionally bearing two strong veins from above the base, except in the intra-spicular prophylls of the tribe Hypolytreae, which

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\*) Strictly speaking, a prophyll is a bracteole on a pedicel arising from the axil of bract. In the spikelets of Cyperaceae, however, a scale, which has been commonly called a prophyll, is apparently a metamorphosed bract scale in my opinion. It would have become empty by the abortion of its axillary flower secondarily. Thus the so-called intraspicular prophylls in Cyperaceae are not homologous with the prophylls in the Dicotyledones, though they became analogous in their apparent position and in their form. But, at present, there is no special term to represent this metamorphosed lowest floral scale of the spikelets of Cyperaceae, so that I reluctantly call it a prophyll in this paper for the time being. Only in the Caricoid genera, it can be called an utricle because of its saclike shape.



has a kind of double prophylls of Goebel and Rüter.

(2) Prophylls called perigynia or utricles appear in the spikelets of Caricoid genera. This structure was once thought to be an intra-floral organ, Willdenow and Nees explaining it as being homologous to the perianth, until Kunth showed its bracteal nature. Then Pax and Kükenthal concluded that it is the first scale on the flower-bearing branchlet at the axil of the so-called pistillate floral scale, a conclusion to which I find no objection. The utricular prophylls of *Carex* and *Uncinia* are morphologically the most specialized bracteal leaf variation, becoming a true sac-like structure inclosing a pistillate flower. Because of the polymorphy of the utricles, it is taxonomically the most important structure used in specific differentiation. A typical utricular prophyll of *Carex* consists of two parts, a lower inflated portion usually with two veins, and a beak. The apex of the beak is usually bidentate, each tooth terminating one of the lateral veins. Like the tubular prophyll mentioned above, this pair of lateral veins has led some specialists to consider the double origin of the utricle. However, these parallel veins are always obscure at the base among many other vascular bundles. The corresponding utricular prophylls of *Kobresia* and *Schoenoxiphium* are not perfectly sac-like, but are deeply or completely split on the adaxial side. Furthermore, spathe-like prophylls usually lack the parallel veins. These utricular prophylls subtend only one branchlet, suggesting their simple origin. The prophylls of Caricoid genera are as a rule flower-bearing structure.

Sometimes the utricular prophyll becomes secondarily empty. In typical Indocarices, a utriculiform prophyll is always present at the base of the so-called spikelet. Also in some species of *Carex* section *Mollicullae*, e. g. *C. olivacea*, and *C. japonica* varr., a small secondary rachilla often atypically arises inside the utricles at the base of the pistillate spikelet. In this case, the utricle from which the rachilla arose, is empty, and the secondary rachilla is the axis bearing the utricular prophyll on the first leaf-scale. These two examples show the homologous structures suggesting transitional state between the utricular and tubular types of prophylls.

(3) Prophylls are also present as small scales within the spikelets. In these prophylls, the differences in shape are far less conspicuous than in the tubular and utricular prophyllar examples just discussed. These differences occur according to their position within spikelets.

In *Cyperus* there is one prophyll in each spikelet, although there are two empty scales at the base of each spikelet. They are smaller than the upper flower-bearing scales. The lower of these empty scales is a reduced bract scale, from the axil of which the rachilla of the spikelet arises, and the upper empty scale has been called the prophyll. Although in external appearance there is very slight morphological difference between this prophyll and the other floral scales, the prophyll tends to have a pair of veins stronger than the others on its dorsal side at least above the base, so that the apex of the prophyll is constantly truncate or rounded and not acute. In *Cyperus amuricus*, prophyll is distinguished

only by its smaller size and more obtuse apex. In *Cyperus serotinus* and *Cyperus pilosus*, the prophylls tend to have a pair of strong veins. The same thing is observed in the spikelets of *Kyllinga*, *Mariscus* and *Remirea*. In these genera, the lower floral scales are often empty, as are the two basal scales, suggesting a transition to a condition in which there are several prophylls. Of the two inner scales of the spikelets of *Lipocarpha*, the lower one is also a prophyll in my opinion. According to Blaser, it has five veins, but only the two lateral ones have vascular elements.

It is of significance that the prophyll is invariably close to the lower bract which subtends the spikelet or its peduncle. When the spikelet is sessile, the prophyll is contiguous with the next floral scale above, but if the spikelet is pedunculate, the prophyll remains at the base of the peduncle apart from the body of the spikelet. In pedunculate spikelets, the prophyll is tubular with connate margins and two prominent veins.

In most Scirpoid and Rhynchosporoid genera, the prophyll is not distinguishable, unless the spikelet is pedunculate. In the sessile spikelets of *Eleocharis* and *Eimbristylis*, the lowest scale other than the bract scale is, as a rule, fruit-bearing. Thus no prophyll is distinguishable in the spikelets of these Scirpoid genera. Rhynchosporoid spikelets are characterized by having a few small empty scales on both basal and apical parts of the spikelets. It is difficult there to identify any prophyll.

As is explained in the next chapter on page 51, in the spikelets of Mapanioid genera there is always a pair of lateral scales. These two scales are morphologically only opposite two staminate floral scales at the base of the spikelet, but they can be regarded as prophylls because they are morphologically more or less different in shape especially having a sharp keel scabrous with short spinules usually, and they are constantly lateral to the rachilla, whereas the other scales are spirally imbricated. In *Scirpodendron*, the prophylls are an opposite pair of scales, but in *Hypolytrum pungens* or *Mapania africana*, this pair of prophylls is connate on both margins and becomes sac-like to some extent. Thus the sac-like prophylls of the Mapanioideae are apparently a double origin and are morphologically quite different from the utricular prophylls of the Caricoideae.

## 2. Structure of spikelets.

High complexity and morphological diversity in the spikelets of Cyperaceae have long been much argued in discussion of the taxonomy and morphology of the glumiflorous families. In Cyperaceae, the delimitation of supra-generic groups is based entirely on the structure of the spikelets. Variations in the interpretations of this structure is the cause for many intergeneric transfers often involving other subfamily divisions. This variation in cyperaceous spikelets concerns the reduction and the metamorphosis of both intra- and extra-floral scale leaves. The so-called prophylls of Cyperaceae are metamorphosed scale-leaves. Many kinds of reduced structures in spikelets have been used to define the

Rhynchosporoid, Caricoid, Sclerioid and Mapanioid genera. It is generally recognized in discussing the structure of the spikelets that those of Scirpoid genera are the least metamorphosed. It is also here recognized that the spikelets of the other genera are probably derived from these simpler groups.

### (1) Scirpoid type spikelets.

The spikelets of the genus *Scirpus* typically have tightly and spirally imbricated bract-scales bearing an axillary hermaphrodite flower. Fig. 1 U shows the schematic expression of this Scirpoid type of spikelets. The bract scales, usually described as floral scales, are homologous with normal leaves. Bract-scales, including the lowest one, are as a rule floriferous and there is no intra-spicular prophyll. The spikelets of *Scirpus*, *Eleocharis*, *Fimbristylis*, *Ficinia*, *Bulbostylis*, *Eriophorum*, *Fuirena*, and a few others are of this type. When the hypogynous bristles remain in the hermaphrodite flower, they are morphologically homologous to the perianth, so that the flowers are a truly axillary. In *Scirpus Roylei*, and several species of *Fimbristylis* and *Bulbostylis*, the floral scales are distichous. In some species of *Fimbristylis*, the decurrent base of the bract scales is continuous to the wings of the winged rachilla, but not in *Scirpus*. Furthermore, in *Fimbristylis* and *Bulbostylis*, the flowers have no perianth bristles. These things show that *Fimbristylis* and *Bulbostylis* are phylogenetically more advanced than *Scirpus* and closer to *Cyperus*.

### (2) Cyperoid type spikelets.

The Cyperoid type of spikelets differs from the Scirpoid type mainly in always having distichous floral scales and in the fact that the lowest bract scale becomes a prophyll. As interpreted in the preceeding chapter, the two lower empty scales consist of a bract and a prophyll. The bract subtends the spikelet, and belongs to the rhachis, while the prophyll belongs to the rachilla. This prophyll is interesting in that, when the rachilla of the spikelet has a joint at its base, the prophyll always remains on the rhachis together with the lower bract of the spikelet. In the development of pedunculate spikelets the prophyll, which in sessile spikelets is intra-spicular, remains at the base of the peduncle as an extra-spicular prophyll. In *Kyllinga* and *Mariscus*, the rachillas are jointed at the base of the spikelets, but those of *Eucyperus* are not articulated. In *Torulinium*, the spikelets are jointed both at the base of the spikelets and at the base of each floral scale on the rachilla.

A more reduced condition can be seen in the spikelets of *Kyllinga*. Here, besides the prophylls, there are always 1 to 3 empty scales on the rachilla of the spikelets (Fig. 1 G-H). These empty scales are apparently the floral scales which have lost their axillary flowers. They give us a clue to settle the question of the taxonomic position of *Remirea* and *Lipocarpa*. The spikelets in these genera are, in my opinion, nothing else than a special development of the Cyperoid type of spikelets. Thus, I agree with Kern, who showed that the lowest empty scale of the spikelets of *Remirea* is a prophyll, the uppermost corky organ is a vestigial rachilla, and the other empty scales are more or less reduced floral scales.



Fig. 1. Scirpoid, Cyperoid and Rhynchosporoid types of spikelets.

A-C: *Cyperus distans*. A. Total spikelet. B. Bract of spikelet and metamorphosed lowest floral scale, i.e. the so-called prophyll. C. Floral part, showing floral scale and its winged base. D. Schema showing typical *Cyperus* type of spikelets. E-H: *Cyperus brevifolius*. E. Total spikelet. F. Rhachis of spike, showing the attrication at base of spikelets, three with remaining bract and the lowest metamorphosed floral scale. G, H. Schemata of spikelets. I-K: *Cyperus pedunculatus* (= *Remirea maritima*). I. Total spikelet. J-K. Schemata of spikelets. L-P: *Cyperus Zollingeriana* (= *Lipocarpa microcephala*). L. Bract of spikelet (b) and the lowest floral scale, i.e. the so-called prophyll (p). M. Achene and the floral scale subtending it. N. Ditto, dorsal view. O, P. Schemata of spikelets. Q-T: Rhynchosporoid type of spikelets. Q. Total spikelet of *Schoenus brevifolius*. R. Ditto, with floral scales removed. S. Schema of spikelets of *Cladiinae*. T. Ditto, *Rhynchosporinae*. U. Schema of typical Scirpoid type of spikelet. (Icon. origin.)



Similar case occurs in the spikelets of *Lipocarpha*, in which the spikelet, considered by many authors as "a flower," consists of an outer herbaceous scale and a pair of hyaline scales which dorsiventrally cover a hermaphrodite flower (Fig. 1, L-P). Of these two inner scales, the lower one or the adaxial one is a prophyll, while the upper one or the abaxial one is the floral scale of the hermaphrodite flower. So that the spikelets of *Lipocarpha* are one-flowered spikelets of Cyperoid type. Blaser demonstrated that in the lower inner scale (=prophyll), there are 5 veins, but only the two lateral ones have vascular elements. This evidence well shows the prophylloid nature of this lower inner scale. Characteristically, a pair of parallel veins remains on a prophyll and the midvein disappears. Furthermore, in all species of *Lipocarpha* the stamens appear between the achene and the upper inner scale, a condition that is general throughout the Cyperaceae. The rachilla of the spikelet of *Lipocarpha* coincides with that of *Kyllinga* also in being articulated at the base of the rachilla, and the lower inner scale usually remains below the articulation together with the herbaceous bract scale, when a spikelet falls off. For these reasons I have taken *Lipocarpha* out of Mapanioideae and placed it next to *Kyllinga* in the Scirpoideae together with *Remirea*.

Of all Cyperoid types of spikelets, those of *Kyllinga*, *Remirea* and *Lipocarpha* evidently phylogenetically more advanced than the others. In addition to having reduced empty floral scales, the spikelets of these genera always occur in heads or head-like clusters. The jointed rachilla of the spikelets, always occurring in the advanced Cyperoid type spikelets, seems to be a later development as compared with the continuous rachillae in *Eucyperus*, *Pycurus*, and *Juncellus*.

### (3) The spikelets of *Dulichium*.

The spikelets of *Dulichium* are morphologically noteworthy. *Dulichium* is a monotypic genus endemic to North America, with one species *D. arundinaceum* Britton. There are two opposing opinions on the "spikelet" of *Dulichium*. The inflorescences consist of 3 to 13 "spikes" spicately arranged on a slender branch arising from the axil of a bract leaf on the upper part of the culms. Several to many scales are distichously arranged on these "spikes." Each scale bears a "flower" consisting of 6 to 9 bristles, 3 stamens, and a pistil. There is usually no empty scale even at the base of the "spike."

If the "flower" is truly hermaphrodite and the bristles are homologous with the perianth, the "flower" is axillary and its scale is a normal floral bract-scale, the same as those of *Cyperus* and *Scirpus*. In this case, the unit "spike" should be a true spikelet. This concept was supported by Blaser (1941) in his anatomical study on *Dulichium*, in which he considered that the *Dulichium* flowers are not fundamentally different from those of *Juncellus*.

On the other hand, Mattfeld (1938) explained the *Dulichium* flower as being a synanthium composed of two unisexual flowers and an empty bract leaf. This view was denied by Blaser (1941), but recently again supported by Schultze-Motel (1959). According to him, the "hermaphrodite flower" of *Dulichium*

is a "synanthium" consisting of a lower staminate flower and an upper pistillate flower. Schultze-Motel indicated in a photograph of the longitudinal sections of a young synanthium that the staminate flower, consisting of three stamens, and the pistillate flower, consisting of a single pistil, are born at different levels (Fig. 2 A). The bristles are interpreted by both of these two authors as homologous

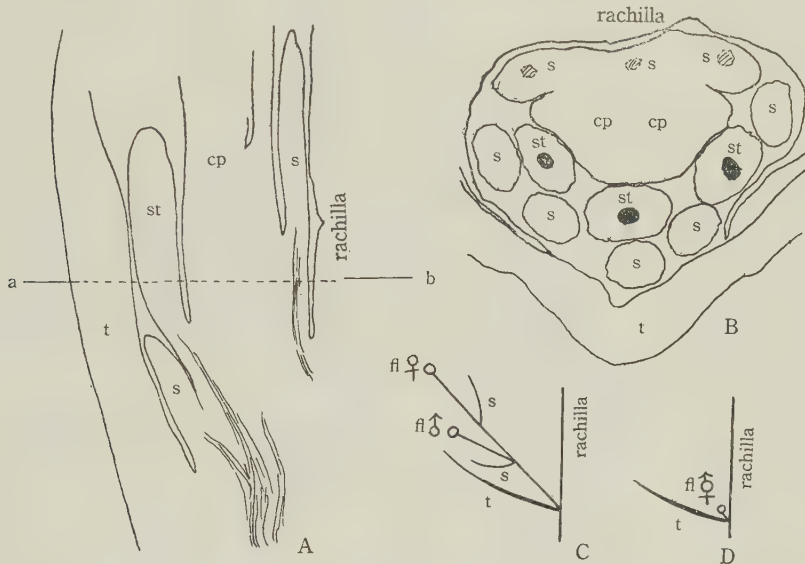


Fig. 2. Spikelet of *Dulichium*. (After Schultze-Motel, 1959).

A: Longitudinal section of a "flower". B: Transverse section of a "flower" at the level indicated in Fig. A as a-b. C: Schematic expression of a "flower" which is considered by Sch.-Motel as a "spikelet". D: Schematic expression of a flower in Koyama's understanding. This co-ordinates the fig. C. t. Floral scale, explained by Sch.-Motel as the bract of spikelet. s. Perianth bristle, explained by Sch.-Motel as floral scale. st. Stamen. cp. Carpel.

with floral scales, supposed to be remnants of the veins of the scales, the abaxial 3 to 6 representing the bract of staminate flower, and the other 3 the bract of the pistillate flower. In this case the true "spikelet" is just what is called a "flower", being made of a bract scale, a pistillate flower and a staminate flower, each distinctly placed on a very abbreviated rachilla (Fig. 2, C).

Transverse sections of a "*Dulichium* flower" have been illustrated by both Blaser and Schultze-Motel independently. I compared and studied both very carefully and found that the two agree with one another in respect to the vascular system in the receptacle. In the receptacular part, there are three main bundles reaching the carpels each of which bears a stamen trace below the disappearing end of the abaxial bundle and the formation of a bicarpellate pistil from the two adaxial bundles. A question is that there is a very slight difference of levels between the traces of stamens and upper bristles. It is true that a difference of level is seen among lower and upper bristles and stamens in the longitudinal

section as showed by Schultze-Motel, but in an axillary flower of Cyperaceae, the division of bundles takes place a little earlier in the abaxial side than in the adaxial side.

I am not in full agreement with these interpretations of the spikelets and the origin of the bristles. In the Cyperaceae, when a scale leaf is considerably reduced, its veins are also reduced by the loss of their vascular elements. However, the midvein remains distinct, usually keeping its vascular elements, even after the extinction of the side veins. If the scale is a prophyll, the midvein is also lost, only a pair of side veins remaining at least to some extent. Therefore it is very hard to suppose that the bristles are homologous with a scale-leaf as Mattfeld considered. I, thus, prefer to follow Blaser in regarding a "*Dulichium* flower" as being a normal axillary hermaphrodite flower born at the axil of a floral scale on a true spikelet (Fig. 2, D), with the bristles homologous to the perianth segments as in *Scirpus*. As to the systematic position of *Dulichium*, I place it near *Scirpus* in the tribe Scirpeae. Though the floral scales are distichous, the lack of prophylls in the spikelets and the presence of perianth bristles in the flower suggest that *Dulichium* does not belong to the tribe Cypereae.

#### (4) Rhynchosporoid type spikelets.

The Rhynchosporoid type of spikelets is also similar to Scirpoid type in the absence of specially developed intraspicular prophylls. Several smaller empty floral scales in both basal and apical parts of the spikelets show that the Rhynchosporoid type of the spikelets is differentiated from the Scirpoid type chiefly by the reduction of the axillary flowers. Kükenthal, in his monograph of the Rhynchosporoideae, divided tristigmatic species of the subfamily into two tribes, Schoeneae with 2-ranked scales, and Cladieae with spirally imbricated scales. In my observation the arrangements of floral scales are, on the other hand, associated with the difference of the types of the reduction of flowers. In the spikelets with distichous scales, the flowers born in the lower part of the spikelets are fruit-bearing, while in those with spirally imbricated scales, the flowers born in the upper parts are fruit-bearing. In Kükenthal's system, the plants with distigmatic flowers are put in the third tribe Rhynchosporae, the spikelets of which have distichously arranged floral scales and a hermaphrodite flower below the imperfect one, if the latter is present. Thus the spikelets of Rhynchosporae are a special development of Schoeneae, and the tribe Cladieae is phylogenetically the least differentiated.

#### (5) Sclerioid type spikelets.

The spikelets of *Scleria* are unisexual except that in the section *Hypoporum*, they are either androgynous or staminate. The staminate spikelets are a typical spike with spirally or more or less distichously imbricated flowers of 1 to 3 stamens. Pistillate spikelets consist of a pistillate flower subtended by a few scales. Some authors described the pistillate flower as terminal, while the others thought that it is an axillary flower of the uppermost scale. In many cases, it is difficult to determine whether it is terminal or axillary, because in a usual pistillate spikelets, several empty scales are imbricated below a pistillate flower which looks terminal.

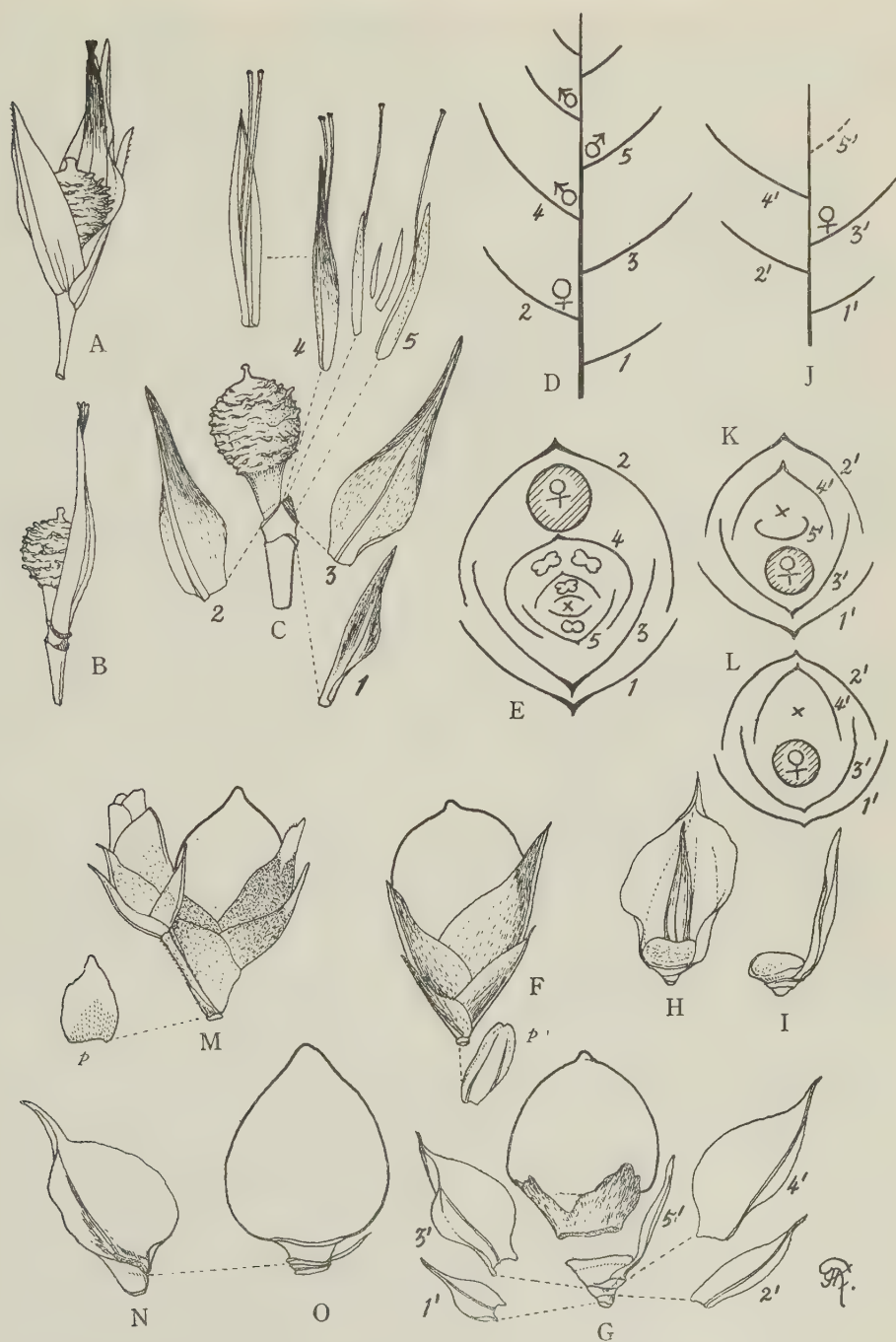


Fig. 3. Scleroid type of spikelets.

A-E: *Scleria* (*Hypoporum*) *verticillata*. A. Total view of a spikelet. B. A spikelet with the scales of the pistillate part removed. C. Analytic expression of a spikelet. 1-3. Floral scales of the pistillate part, including the flower-bearing one (2). 4, 5 and others. Floral scales of the staminate part, with filaments. D, E. Schematic expression of *Hypoporum* spikelet, to be co-ordinated to figs. A-C.

F-L: *Scleria chinensis*. F. Total view of a spikelet. G. Analytic expression of a spikelet. 1' to 5' show floral scales. The numbers are to be co-ordinated to those of fig. C. H & I. Dorsal and lateral views of the vestigial scale. J-L. Schematic expressions of *Scleria* spikelet. K shows the one without any vestigial scale. L shows another one with vestigial scale.

M-O: Spikelet of *Acriurus*.

(Icon. origin.)



The androgynous spikelets of the section *Hypoporum* give a clue to solve this question. As illustrated in Fig. 3, A-E, in the spikelets of *Hypoporum*, a cluster of staminate flowers is attached to the base of the pistillate flower. If this staminate part is a side branch, the pistillate flower is terminal at the end of rachilla. The staminate part, however, has no prophyll at its base, nor is found any bract scale from which the staminate part arises. Moreover in *Scleria gracillima*, which has more or less distichously arranged floral scales on the spikelets, the keel of the lowest scale of the staminate part faces the pistillate flower under it, and the second scale comes to the same direction as the uppermost scale of the pistillate part. Accordingly the staminate part is a continuation of the pistillate part and not a side branch. Thus the pistillate flower is truly axillary. Sometimes we notice a subulate, compressed projection directly below the pistillate flower of the unisexual spikelets in the series *Elatae*, as shown in Fig. 3, G, 5'. The projection is a reduced staminate scale on a very reduced rachilla. This evidence also shows that the pistillate flower is axillary. The diagrams of the Scleroid types of spikelets in Fig. 3 were drawn based on these observations. These diagrams demonstrate that the Scleroid type of spikelets is not fundamentally different from the Rhynchosporoid type, but is in a more reduced condition descended from the latter type. An interesting matter is that such a genus as *Costularia* of the Rhynchosporoideae exhibits many characters similar to the genus *Scleria*, especially the hard, truly globular achenes of several genera of Gahnieae are almost the same as those of *Scleria*. It seems impossible to me to keep the subfamily Sclerioideae apart from the subfamily Rhynchosporoideae.

#### (6) Caricoid type spikelets.

The pistillate flowers of the genus *Carex* present the most strange aspect of all groups of Cyperaceae. The so-called spikes of *Carex* consist of several to many sac-like organs commonly called an utricle, each subtended by a scale leaf usually described as a glume or a floral scale. Strictly speaking, a unit of utricle is a true spikelet of *Carex*, as was already stated by Pax and Kükenthal. The scale below the utricle is a bract scale on the rhachis and the utricle is a prophyll on the very abbreviated rachilla arising from the axil of the bract scale. Only one pistillate flower remains on this abbreviated rachilla. This interpretation is strongly supported by the fact that in several species of *Carex*, for example some species of *Careyanae* or *Capitellatae*, a vestigial rachilla is still visible at the base of the pistillate flower in the utricle (=a "prophyll"). Such rudimentary rachillae of *Carex* are no doubt homologous to the secondary rachillae of many species of *Schoenoxiphium* and *Kobresia*. Recently the homology was confirmed by Schultze-Motel on the anatomical bases. In his important contributions, he reported the details of an atavistic spikelet of *Carex canescens* (Fig. 4, B). He explains as, "In der Achsel des Tragblattes  $t_1$  wird ein Seitenspross angelegt. Dieser Seitenspross entwickelt abermals in den Achseln von Tragblättern Seitensprosse, und zwar in der Achsel des Tragblattes  $t'$  (=Utriculus) eine weibliche und in der Achsel des Tragblattes  $t''$  eine (wahrscheinlich) männliche Blüte. Hierbei ist nur zu beachten,

dass das Tragblatt  $t'$ , der Utriculus, die Achse scheidig umgibt, also in Schnittbild auf beiden Seiten der Achse sichtbar wird, das Tragblatt  $t''$  aber nur auf einer Seite der Achse liegt."

The atavistic spikelet of *Carex canescens* has quite the same structure as those of *Kobresia* and *Schoenoxiphium*. The spikelets of these latter two genera consist of few to many floral scales spicately disposed on a rachilla. The lowest floral scale, constantly bearing a pistillate flower, is unexceptionally metamorphosed to a "prophyll." In *Kobresia*, the prophylls are generally spathe-like having quite or mostly free margins, while in *Schoenoxiphium*, the prophylls are sac-like with perfectly connate margins. The prophylls in this latter state are called utricles. All the other floral scales, each bearing a staminate flower, are scale-like not being metamorphosed at all. In *Carex* and *Uncinia*, all these staminate flowers of the spikelets are lost, so that they are in the ultimate state in a reduction series of spikelets in the Caricoideae. All what I have stated here are expressed schematically in Fig. 5 (p. 52). The subfamily Caricoideae is a natural group characterized by the Caricoid type of the spikelets.

As mentioned in the previous chapter, I believe that the prophylls of the Caricoideae are a single origin. The Caricoideae, therefore, would have not descended from the Mapanioideae with the prophylls of manifestly a double origin.

#### (7) Mapanioid type spikelets.

Fig. 6, A & B (p. 54) show a unit of an inflorescence of *Mapania nudispica*. The unit has been accepted either as a hermaphrodite polyandrous flower or a spikelet with a terminal pistillate flower and several monandrous staminate flowers. I have no hesitation to concur in the latter view and call the unit a spikelet. As I have already stated (T. Koyama, 1959), the so-called "Synanthienhypothese von Mattfeld" is reasonably accepted to elucidate the spikelets of such Mapanioid genera as *Mapania*, *Hypolytrum*, *Scirpodendron*, *Exocarya*, *Lepironia*, *Chorizandra*, and a few others. In 1915, Mattfeld presented a new idea to interpret the her-

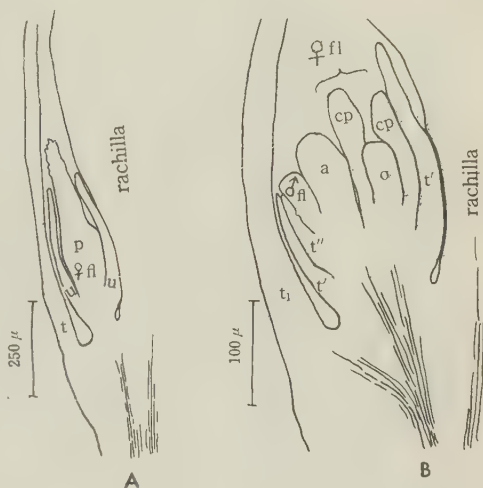


Fig. 4. Longitudinal sections of flowers of *Carex curta* Gooden. (After Schultze-Motel, 1959).

A: A young normal pistillate flower.  $t$ . Floral scale.  $u$ . Prophyll or the so-called utricule.  $p$ . Pistil.

B: An abnormal condition of the floral part, which actually became a "bisexual spikelet" bearing a staminate flower.  $t_1$ . Floral scale, which corresponds to  $t$  of fig. A.  $t'$ . Prophyll, which corresponds to  $u$  of fig. A. The prophyll ( $t'$ ) subtends a pistillate flower consisting of carpels ( $cp$ ) and an ovule ( $o$ ).  $t''$ . Floral scale born on the rachilla ( $a$ ). A staminate flower is born at the axil of  $t''$ . An utricular unit in this condition is quite the same as that of *Kobresia*.

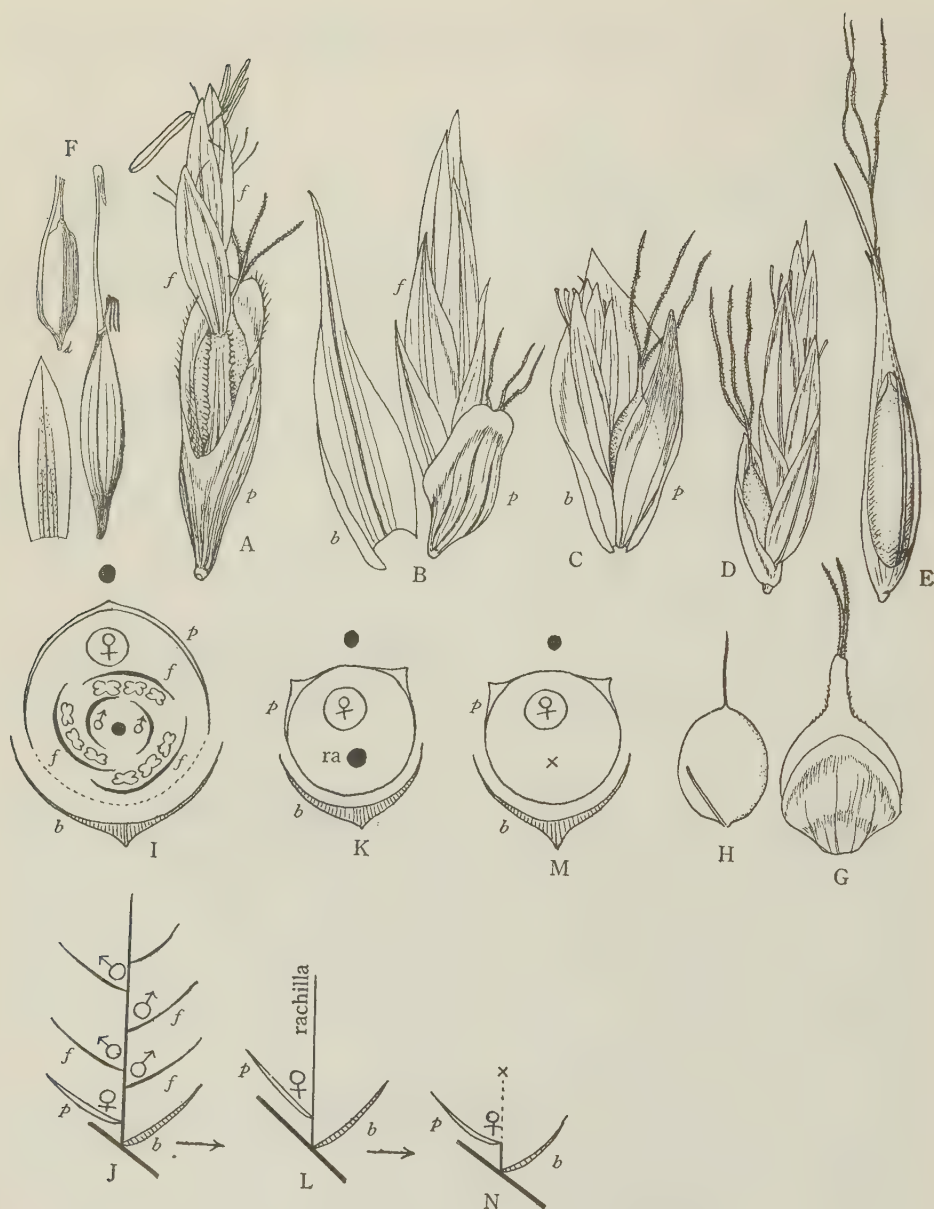


Fig. 5. Caricoid type of spikelets.

A-B: *Schoenoxiphium*. A. A spikelet without its bract. B. A spikelet and its bract. C-E: *Kobresia*. C. A bisexual spikelet with its bract. D. Ditto without its bract. E. An utricle of *Kobresia laxa* with a vestigial rhachilla. F: Utricular part of *Uncinia*. G-H: Utricular part of *Carex capitata*, a rhachilla-bearing example. I-M: Schematic expressions of various Caricoid types of spikelets. I, J. *Kobresia* type. K, L. *Uncinia* type. M, N. *Carex* type. (Icon. origin.)

maphrodite flower of Scirpoideae which, at that time, also generally included the Mapanioideae of the present day. He interpreted the hermaphrodite flower as being a synanthium consisting of a reduced pistillate and one or more staminate flowers, as follows: "Unter einer weiblichen, nackten Blüte steht eine grössere Zahl von Fächeln aus monandrischen Blüten. Diese Fächel werden reduziert auf eine Blüte. Die Zahl der Fächel unter der weiblichen Blüte nimmt ab, so dass die weibliche Terminalblüte schliesslich von mehreren Staubblättern umbegen ist, die aber jedes sein eigenes Tragblatt haben. Schliesslich ist die Zahl der monandrischen Blüten auf 3 oder 2 reduziert, so dass zwischen den Staubblättern keine Tragblätter mehr stehn können, sondern nur noch aussen von ihnen; und so ist eine von einigen Tragblättern umhüllte 'Blüte' entstanden, die von einer Zwitterblüte von *Scirpus* nicht zu unterschieden ist."

A Mapanioid spikelet thus consists of a bract scale, a pair of lateral scales, a terminal pistillate flower, and variously arranged small floral scales each subtending a stamen. The bract scale is a leaf on the rachis from the axil of which arises the rachilla of the spikelet. The two lateral scales are prophylls, as mentioned in the preceeding chapter on page 43. Each prophyll usually has a stamen, so that it is a monandrous staminate flower. Prophylls are always more or less different from other floral scales in their shape, especially in the prominent keel which is very often variously scabrous and has many spinules as in *Parapania*. The other floral scales between the prophylls and the pistil, are undoubtedly merely floral scales of staminate flowers. In *Scirpodendron*, *Chrysithrix*, and *Chorizandra*, they are numerous and arranged spirally. In *Mapania* they are usually reduced to one, being on the adaxial side of the main axis, so that they are often described as "squama dorsalis." These scales with the stamen at each axil constitute monandrous flowers. The pistil is, therefore, accepted as a terminal pistillate flower of the spikelet. Usually it is subtended by small scales, two or three in *Mapania* and four in *Lepironia*. Because these pistillate scales are slightly different from the staminate scales, and because there are three with a trigynous pistil and two or four with a digynous one, they can logically be considered as perianth segments. Although there are no anatomical data to support this fact, the pistillate flower seems to be really terminal since there is no extrafloral scale below the pistillate flower, nor is there any vestigial rachilla at the base of the pistillate flower. The spikelets of *Hypolytrum* are the simplest of all these Mapanioid types. They have lost the pistillate perianth and all staminate flowers except for the basal prophyllate pair. Considering that the progressive reduction of organs is the main feature in the morphological development within the Cyperaceae, *Hypolytrum* and their close allies have apparently descended from a prototype like *Scirpodendron*. The subfamily Mapanioideae appears to be the most distinctive of all subfamilies of Cyperaceae because of their cymose spikelets, all the other having spikeate spikelets.





Fig. 6. Mapanioid type of spikelets.

A-F: *Mapania nudispica*. A. Bract. B. Achene with perianth bristles and scales. C, D. Lateral and dorsal views of prophyll. E. Dorsal floral scale. F. Perianth bristle. G, H: *Hypolytrum Ohwianum*. G. Prophyll with stamens and pistil. H. Floral scale. I-K: *Lepironia mucronata*. I. Floral scale with withered filament. J. Prophyll with withered filament. K. Achene with perianth bristles. L-T: Schematic expressions of the Mapanioid type of spikelets, showing the various degrees of reduction from *Scirpodendron* type (L-N) to *Hypolytrum* type (S, T) through *Mapania* type (O-R). (Icon. origin.)

### 3. Systematic significance of the unifacial blades of Cyperaceae.

Many species of the Cyperaceae have unifacial leaf-blades, these being one of the most distinctive features of the vegetative parts of this family. The unifacial

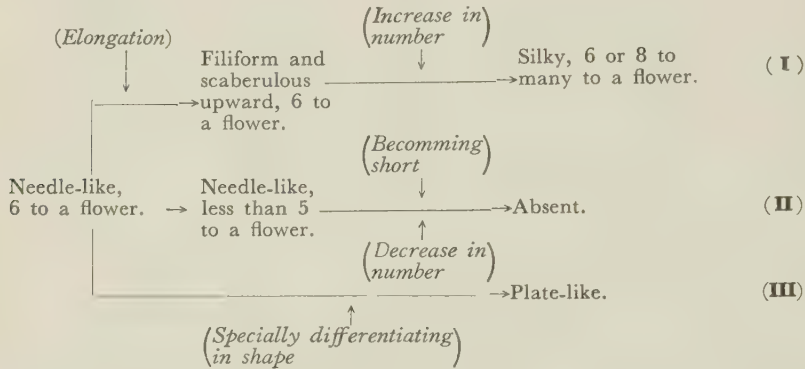
condition varies to a bladeless sheath in accordance with the reduction of the leaf-blades, hence we sometimes call the complete reduction of the blade the "Binsenform." In the Cyperaceae, unifacial blades occur in four of the eight tribes, viz. Scirpeae, Cypereae, Cladieae and Mapanieae. In *Scirpus*, *Eleocharis*, *Lepidosperma*, *Machaerina*, *Tetraria*, *Schoenus*, *Lepironia*, *Chrysithrix*, and *Chorisandra*, all or the majority of the members have unifacial blades, while in *Cyperus* and *Fimbristylis*, there are very few species with so greatly reduced leaf blades. The lowest bract leaf of the inflorescence of these plants is a typical unifacial, culm-like blade, so that the inflorescence appears to be lateral outwardly, such as those of *Scirpus mucronatus*. The leaves are of two kinds: those with sheaths and blades, and those consisting only of a sheath. Most species of *Machaerina* have leaves of the first kind. They are either terete or bilaterally compressed (ensiform). Bladeless sheaths are common in *Scirpus*, *Eleocharis*, *Cyperus*, *Schoenus*, *Lepironia*, *Chorisandra*, etc. From the phylogenetical point of view, we regard the bladeless sheaths as being a more specialized condition.

Extensive anatomical investigations on the "Binsenform" have been made by Peisl (1957), and in his account he concluded that the unifacial blades in Cyperaceae occur in the relatively primitive groups, though they are a more morphologically advanced than are the gramineous dorsiventral ones. I quite agree with him as I have already stated in my treatment of the genus *Scirpus* in 1958. In Scirpeae the subgenus *Isolepis* has unifacial blades. It is a rather primitive group but is fairly well specialized and occupies a large side branch on the phylogenetic tree, as I described. As also mentioned by Peisl, it is of interest that in Cyperaceae both the plants with unifacial blades and those with a normal dorsiventral blades belong to the same genus. This seems to indicate the parallel evolution in the leaf form in various series of genera, each developing the "Binsenform." This parallel development differentiates the relatively primitively groups of the Cyperaceae.

#### 4. Hypogynous bristles.

Hypogynous bristles are represented in many genera of Scirpoideae and Rhynchosporoideae. Blaser (1941) demonstrated by anatomical studies that the hypogynous bristles of the Cyperaceae are perianth segments. The hypogynous bristles of the Scirpoid genera have been fully discussed by me (1958), morphologically and taxonomically with special reference to its phylogenetic significance. Most species of *Scirpus* have in each flower six needle-like scabrous bristles with minute spinules. The flat filiform type occurs in *Baeothryon*, where the bristles are quite silky and elongate much after flowering. The bristles of *Eriophorum* are identical with this silky type, but there are eight or more in each flower. Blaser discussed the homology between the bristles of *Scirpus* proper and *Eriophorum*. In 1958 I pointed out that *Eriophorum* represents the ultimate state having more numerous and morphologically specialized bristles, these derived from the needle-like ones through a filiform transitional form. The perianth-like bristles of

*Fuirena* are an ultimate form in another series of differentiated genera. The following diagram summarizes these trends.



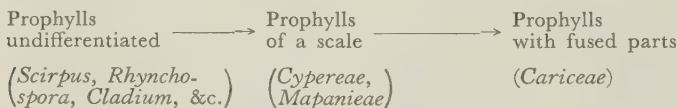
The bristles in the Rhynchosporoideae are not so divergent morphologically as are those in the Scirpoid genera, being needle-like occurring in the second trend in this diagram.

## 5. Conclusion.

(1) The so-called prophylls of Cyperaceae are scale-leaves, identifiable by their special position and metamorphosis.

(2) In accordance with the position, the so-called prophylls can be conveniently divided into two classes: intra-spicular and extra-spicular.

(3) Various degrees of differentiation of forms in the intra-spicular prophylls make it possible to draw the following trend in order to conduce to phylogenetic observations.



(4) In the Cyperaceae there are both cymose and spicate spikelets.

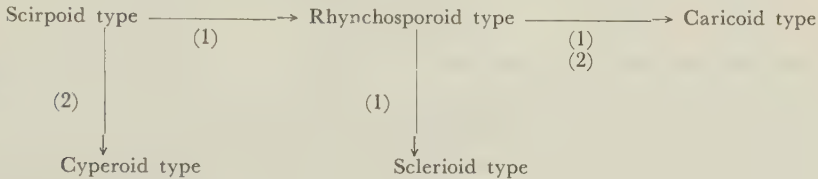
(5) Cymose spikelets occur only in the Mapanioideae, each with a terminal pistillate flower above a few to many monandrous staminate flowers. The accompanying prophylls are scale-like or rarely more or less utricular prophylls of double origin.

(3) All the subfamilies except the Mapanioideae, have the spicate spikelets, consisting of spirally or distichously arranged floral scales, each with an axillary flower. In the degree of differentiation of the prophylls and the degree of reduction of the floral scales and flowers, the spicate spikelets can be grouped into five kinds: Scirpoid, Cyperoid, Rhynchosporoid, Sclerioid, and Caricoid types.

(7) The morphological differentiation of prophylls occurs in the Cyperoid type. The reduction of flowers occurs in the Rhynchosporoid and Sclerioid types.

the latter having no hermaphrodite flower. A specially differentiated prophylls, called an utricle, occurs in the Cyperoid type.

(8) Since the reduction and metamorphosis are considered as later-developed characters, the following phylogenetic trend can be deduced based on the sex of the flowers and the shape of the prophylls.



(1) : Reduction of floral components.

(2) : Differentiation in the so-called prophylls or the lowest floral scale of aspikelet.

### Classification of the family

#### 1. Historical summary.

In the classification of the family Cyperaceae, Nees was the first author who dealt with the tribes of the family. In 1835, he created nine tribes: Cypereae, Hypolytreae, Chrysitricheae, Scirpeae, Rhynchosporeae, Cladieae, Sclerieae, Elyneae and Cariceae. Then he added two more tribes, Ficiniae and Fuireneae, in his later contribution for the *Flora Brasiliensis* Vol. 2 (1842). All these tribes are validly published nomenclatorially and are the starting points of the tribes of the family.

Later on, when these tribes were systematized, the sex of the flowers first caught the attention of the specialists concerned. Bentham and Hooker (1883), entirely depending upon the floral sexes, divided the family into two main groups, viz. Monoclines with hermaphrodite flowers and Diclines with unisexual flowers, as follows.

##### A. Monoclines.

Tribe 1. *Scirpeae*.

Tribe 2. *Hypolytreae*.

Tribe 3. *Rhynchosporeae*.

##### B. Diclines.

Tribe 4. *Cryptangieae*.

Tribe 5. *Sclerieae*.

Tribe 6. *Cariceae*.

This idea was followed by Hutchinson (1936, 1957) and Mattfeld (1936). But the latter author transferred the tribe Hypolytreae, which, in his opinion, belongs to "Diclines" as it has the so-called synanthia consisting of a terminal pistillate flower and several staminate flowers below it, as interpreted in the preceding chapter. The following is the system given by Mattfeld.



- |                                   |                           |
|-----------------------------------|---------------------------|
| Unterfamilie <b>Caricoideae</b> : | 1. <i>Cariceae</i> .      |
| (Unisexual flowers)               | 2. <i>Lagenocarpeae</i> . |
|                                   | 3. <i>Sclerieae</i> .     |
|                                   | 4. <i>Hypolytreae</i> .   |
| Unterfamilie <b>Scirpoideae</b> : | 5. <i>Scirpeae</i> .      |
| (Hermaphrodite flowers)           | 6. <i>Rhynchosporae</i> . |
|                                   | 7. <i>Cypereae</i> .      |

In my opinion, the tribe Cryptangieae and the tribe Lagenocarpeae are the same, and Scirpoideae and Caricoideae of Mattfeld's sense represent the Monoclines and the Diclines of Bentham and Hooker respectively.

In 1902, Ascherson and Graebner separated the subfamily Rhynchosporoideae from the subfamily Scirpoideae to include such tribes as Rhynchosporae and Cladieae. The difference between Rhynchosporoideae and Scirpoideae is that the spikelets of the former have many empty floral scales and only a few fruit-bearing flowers, as I interpreted in the preceding chapter. Thus the family was divided into three subfamilies by them, viz. Scirpoideae, Rhynchosporoideae and Caricoideae. Because no species of the tribe Hypolytreae occurs in the region treated by Ascherson and Graebner, they did not mention about its systematic position. Ohwi mostly agreed with them, when he published his system covering the Eastern Asiatic genera in 1944. He added two more tribes to the subfamily Rhynchosporoideae. They are Gahnieae and Sclerieae, which also do not occur in the region referred to by the former two authors, but it is easy to suppose that they would have done so, too, if represented. Ohwi's system is as follows.

- |                                    |                           |
|------------------------------------|---------------------------|
| Subfam. <b>Scirpoideae</b> :       | 1. <i>Scirpeae</i> .      |
|                                    | 2. <i>Hypolytreae</i> .   |
| Subfam. <b>Rhynchosporoideae</b> : | 3. <i>Rhynchosporae</i> . |
|                                    | 4. <i>Gahnieae</i> .      |
|                                    | 5. <i>Sclerieae</i> .     |
| Subfam. <b>Caricoideae</b> :       | 6. <i>Cariceae</i> .      |

The systems proposed by both Ascherson and Graebner, and Ohwi are roughly speaking, based upon the combination of the sex of flowers and the numbers of fertile flowers within a spikelet. In the Cyperaceae, the sex of flowers shows nothing else than a phylogenetic tendency of characters. Namely, it is evident that the unisexual flowers developed from the hermaphrodite ones through an intermediate state seen in Rhynchosporoideae, in which rudimentary pistils still remain in the staminate flowers. The Mattfeld's system is, therefore, very artificial, though his transfer of Hypolytreae was correct. It is now generally understood, that the Sclerieae is more closely allied to the Rhynchosporae than to Cariceae. I think the separation of the Rhynchosporoideae is reasonable. As was already stated by me, it is a natural group on a side branch of the phylogenetic tree of the family. The genera of Rhynchosporoideae are well delimited by the reduction of flowers. But, I can not agree with Ohwi in putting the Hypolytreae in the Scirpoideae. Only the species of this tribe have cymose inflorescences

terminated by a pistillate flower. It is, therefore, quite distinct from any of all the three subfamilies regarded by Ohwi. The systems depending on the sex and number of flowers seem to be summarized in the following Mackenzie's one, which has been proposed for the North American Flora, Vol. 18.

Flowers hermaphrodite :	Spikelete many-fl.	Tribe 1. <i>Scirpeae</i> .
	Spikelets 1-2-fl.	Tribe 2. <i>Rhynchosporeae</i> .
Flowers unisexual :	Achenes naked.	Tribe 3. <i>Sclerieae</i> .
	Achenes in a closed sac.	Tribe 4. <i>Cariceae</i> .

Here it is appropriate to make the appraisal of C. B. Clarke's system. Among several systems made by him, one published in the Flora of Tropical Africa, Vol. 8 (1901) is accepted as his final one because a similar system was adopted in his New genera and species of Cyperaceae, which is an abstract of his extensive monograph of the family. In his system, the family was divided into three subfamilies: Scirposchoeneae, Mapaniae and Cariceae, as follows.

Suborder I. <b>Scirpo-Schoeneae :</b>	1. <i>Cypereae</i> .
	2. <i>Scirpeae</i> .
	3. <i>Schoeneae</i> .
Suborder II. <b>Mapaniae :</b>	(4. <i>Mapanieae</i> = <i>Hypolytreae</i> ).
Suborder III. <b>Cariceae :</b>	(5. <i>Cariceae</i> , including <i>Carex</i> and <i>Scleria</i> ).

However, his naming of the subfamilies is illegitimate. These subfamiliar names were corrected in accordance with the present rules by Marloth in his Flora of South Africa (1915), where he fully accepted the above Clarke's system as follows.

Subfam. I. <b>Scirpoideae :</b>	1. <i>Cypereae</i> .
	2. <i>Scirpeae</i> .
	3. <i>Schoeneae</i> .
Subfam. II. <b>Mapanieae :</b>	4. <i>Mapanieae</i> .
Subfam. III. <b>Caricoideae :</b>	5. <i>Sclerieae</i> .
	6. <i>Cariceae</i> .

The Clarke's system has a remarkable progress in creating a new subfamily, Mapanioideae, to accommodate the genera of the tribe Hypolytreae. As I fully discussed in the preceeding chapter, the Mapanioid genera are neither Scirpoid groups nor Caricoid ones, but are quite distinct from all the groups of the family hitherto been described. Only in the Mapanioideae, spikelets are cymose with a terminal flower, while in the others, they are spicate with axillary flowers only. But I am not in agreement to put *Scleria* and *Carex* in the same subfamily. The genus *Scleria* are more closely related to the Rhynchosporoideae in its spikelets without any metamorphosed intra-spicular prophyll. Because of its unisexual flowers, some specialists accept the subfamily Sclerioideae to include the genus *Scleria* and its immediate allies. But the sex of flowers is not so important as the structure of spikelets, and I prefer to put the tribe Sclerieae in the subfamily Rhynchosporoideae.

Strictly speaking, the presence of the terminal flower of spikelets was first noticed by Pax about twenty years earlier than C. B. Clarke. In 1886 describing the Cyperaceous part for Englers Das Pflanzenreich, he divided the family into two subfamilies, Scirpoideae and Caricoideae. In this classification, he designated that in the Scirpoideae, the spikelets have no terminal flower, but it was very regrettable misunderstanding that actually he placed the tribe Hypolytreae in the Scirpoideae.

## 2. Delimitation and interrelationship of the subdivisions of Cyperaceae.

In the previous chapter I stated that the classification of the major subdivisions of the family has hitherto been based on the sex of flowers, the number of fruit-bearing flowers within a spikelet, and the presence or absence of the terminal flower in some cases. This last character is the most important, however, the "terminal flowers" of the Cyperaceae have been frequently misunderstood by various specialists. For example, the flowers of *Carex* and *Scleria*, which have been said to be terminal, are actually lateral in morphological sense. The sex of the flowers are, in my opinion, less important to divide the major groups. In the morphological discussion of the family, I added the prophyll as one of the most important characters to delimit the larger groups, having discussed their significance in taxonomy. Chiefly depending on these characters and referring to the various systems hitherto been proposed by various authors, I hereby propose to divide the family into the following six tribes of four subfamilies.

Subfam. I. **Mapanioideae** C. B. Clarke (1901).

Tribe 1. Hypolytreae Nees (1835) (= *Chrysitricheae* Nees; *Mapanieae* Marloth).

Type: *Hypolytrum* L. C. Rich.

Subfam. II. **Scirpoideae** Pax (1886) (= *Scirpo-Schoenoideae* C. B. Clarke, ex p.)

Tribe 2. Scirpeae Nees (1835). Type: *Scirpus* Linn.

Tribe 3. Cypereae Nees (1835). Type: *Cyperus* Linn.

Subfam. III. **Rhynchosporoideae** Ascherson & Graebner (1902) (= *Scirpo-Schoenoideae* C. B. Clarke, ex p.)

Tribe 4. Rhynchosporae Nees (1835). Type: *Rhynchospora* Vahl.

Subtribe i. Cladiinae T. Koyama (1961) (= Trib. *Cladieae* Nees).

Type: *Cladium* Cranz.

Subtribe ii. Gahniinae T. Koyama (1961) (= Trib. *Gahnieae* Pax).

Type: *Gahnia* Forst.

Subtribe iii. Rhynchosporinae T. Koyama (1961) (= Trib. *Schoeneae* C. B. Clarke).

Type: *Rhynchospora* Vahl.

Tribe 5. Sclerieae Nees (1835). Type: *Scleria* Bergius.

Subfam. IV. **Caricoideae** Pax (1886).

Tribe 6. Cariceae Nees (1835) (= *Elyneae* Nees; *Hopieae* Pax). Type: *Carex* Linn.

The subfamily Mapanioideae is the most distinct of all the subfamilies in having the cymose spikelets (see p. 53) consisting of one terminal and several lateral flowers, all the others having spicate spikelets without any terminal flower. The double prophyll consisting of opposite two prophyllar scales is also well

correlating to this cymose nature of the spikelets. In all the other groups, the prophylls are of a single-origin, and scales are constantly alternate. Nees seems to be of opinion to separate the tribe Chrysitricheae from typical Mapaniae. It covers such genera as *Chrysitrix*, *Chorizandra* and *Lepironia*, which have unifacial-bladed or sheath-like reduced leaves and only one cluster of spikelets. These genera, however, are of only the ultimate state within the Mapanioid groups.

The subfamily Caricoeae is defined by the strongly metamorphosed prophylls, which we generally call utricles or perigynia after their bottle-shaped aspect. This intra-spicular prophyll is morphologically homologous with the lowest floral scale of the Scirpoid type of spikelets, thus the unit of pistillate flowers of Cariceae, composed of one utricle and its subtending scale, is actually a much reduced spikelet. The genus *Hoppia* can be distinguished from such genera as *Carex* and *Kobresia* by the dichotomously divided side branches of the partial inflorescences. In *Carex*, the branches of the partial inflorescences are unexceptionally racemosely divided. Furthermore, when the partial inflorescences are bisexual, the staminate spikelets are born below the pistillate ones in *Hoppia*, while above the pistillate ones in *Carex*. Almost all the specialists before Ohwi, have separated the tribe Cariceae from the Scirpoideae and the Rhynchosporoideae by the unisexual flowers, which, however, are of less taxonomic significance but only demonstrate that the Caricoeae is phylogenetically more advanced and specialized than the two latter subfamilies. The subfamilies Rhynchosporoideae and Scirpoideae are morphologically considerably similar to one another. The difference between the two is chiefly the reduction of flowers in the former. The spikelets of the Rhynchosporoideae have some empty floral scales at both apical and basal parts of the spikelets, while in the spikelets of Scirpoideae, all floral scales are flower-bearing. Kükenthal further divided the Rhynchosporoideae into two tribes, viz. Schoeneae and Rhynchosporae, the former of which has trigynous flower, the latter having the digynous ones. On the other hand, Ohwi, however, paid his attention to the different tendency of the reduction of flowers in the Rhynchosporoideae, s. stricto. In the spikelets of *Rhynchospora* and *Schoenus*, the fruit-bearing flowers are born below the sterile flowers, i. e. the lowest flower is always fruit-bearing at least, whereas in *Cladium* and *Gahnia*, the fruit-bearing flowers are born above the sterile flowers, i. e. the uppermost flower is fruit-bearing at least. I follow Ohwi's idea for the reason that the different conditions of the reduction of flowers tend divergently, so that the two groups defined by Ohwi are independent from each other. Ohwi applied the name Gahnieae to the latter group including *Cladium* and *Gahnia*, but nomenclatorically there is still an earlier one, Cladieae. The Scleriae differs from the Rhynchosporae by constantly unisexual flowers and conspicuous hypogynia under pistils. The reason why I placed it in the Rhynchosporoideae is interpreted in the previous chapter in detail (p. 50). As to the subdivision of the subfamily Scirpoideae, the tribe Cyperae is reasonably separable from typical Scirpeae. In the spikelets of the Cyperae, there is always a scale-like prophyll at the base, but never in the spikelets of the Scirpeae. Many authors have





distinguished the Cyperaceae from the Scirpeae by the two-ranked floral scales, so that some of them hardly realized the difference, but this latter character is not the fundamental difference. In *Scirpus Roylei* and the section *Abildgaardia* of *Fimbristylis*, floral scales are also distichous.

The evolutionary tree given in Fig. 7 shows the phylogenetic interrelationship of the subfamilies and tribes of the Cyperaceae discussed above. In order to draw the schema, the following principles were approved by me being pertinent to the differentiation within the Cyperaceae.

(1) Differentiation is led by the reduction of complex parts to simple parts. Thus the unisexual flowers must have been given from the hermaphrodite ones; the few-flowered spikelets would have developed from the many-flowered ones; and the unifacial and bladeless leaves can be derived from the leaves with dorsio-ventral blades.

(2) Metamorphosed parts are given from the non-metamorphosed parts. Thus the scales in the so-called prophyllar condition would have developed from normal bract scales.

(3) This tendency of characteristic differentiation will not be reversed within a simple evolutionary trend, unless the environment makes such a reversal change more adaptable.

In my schema, Scirpoideae, Rhynchosporoideae and Caricoideae are placed along the same evolutionary line. This interrelationship is chiefly depending upon the reduction series of the spicate structure of the spikelets fully discussed and schematically concluded in the previous chapter. This trend is also supported by other morphological evidences. In the structure of flowers, Scirpoideae is also the most primitive of the three, in having the hermaphrodite, trimerous flowers, frequently with 6 or 3 perianth bristles. In Caricoideae, however, the flowers are constantly unisexual without any rudiment of perianth. The flowers of Rhynchosporoideae are of the intermediate state between those of Scirpoideae and of Caricoideae. The metamorphosed intraspicular prophylls are seen in Caricoideae and in the tribe Cyperaceae, either of which is considered as being in an ultimate condition. The interrelationship between *Hoppia* and *Carex* is coordinate like that between Rhynchosporoideae and Cladieae. The tribe Sclerieae is the ultimate group of the Rhynchosporoideae in having unisexual flowers without perianth. The androgynous spikelets of the section *Hypoporum* of *Scleria* suggest its alliance with the Rhynchosporoideae, of which the spikelets bear the fruit-bearing flowers below the sterile ones.

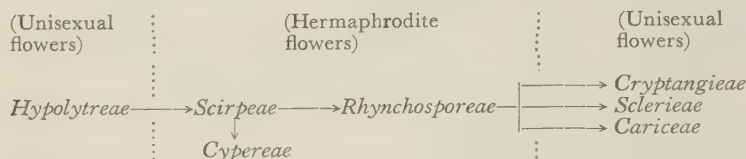
Fig. 7. Schemata showing the phylogeny of the Cyperaceae. The schemata of the spikelets arranged in fig. B may be coordinated to the taxonomic groups arranged in fig. A. Fig. C shows the supposed process of the reduction of spikelets, from the Mapanioid type to the Scirpoid type, i. e. a unit spikelet of the Mapanioid inflorescence is equivalent to a flower of the Scirpoid type of the spikelets.

(1) denotes the occurrence of the reduction in floral parts.

(2) denotes the occurrence of the metamorphosis in the lowest floral scale of the spikelets.

b: bract of spikelet. f: floral scale.

It is of interest that there is a considerable coincidence between the phylogeny supposed by Holttum and that of mine. In 1948, Holttum led the following phylogenetical conclusion chiefly based upon the sex of flowers.



I generally agree with this supposition in the Scirpeae-Cypereae, the Scirpeae-Rhynchosporeae, the Rhynchosporeae-Sclerieae, and the Rhynchosporeae-Cariceae links. But, special mention is needed as to the Hypolytreae link. Because the Mapanioid type of the spikelets is functionally equivalent to the hermaphrodite flower, Holttum thought that the "partial inflorescence (=a spikelet) of the Hypolytreae (=Mapanieae) is the primitive form which gave rise to the flower of *Scirpus*, and is therefore functionally a hermaphrodite flower (partially annotated by TK)". As to the link between the Hypolytreae and the Scirpeae, I am not in full agreement with this view. Although the spikelets of the Mapanioideae are functionally a hermaphrodite flower, they are morphologically a cluster of unisexual flowers as shown in Fig. 6. Since it is very difficult to consider that the unisexual condition will reverse to the bisexual condition, the tribe Scirpeae can hardly be derived from the Hypolytreae (=Mapanieae) in the present criteria. The spike-like unit of the inflorescence of the Mapanieae consists of spicately arranged many spikelets, each showing a cymose structure with a terminal pistillate and some staminate flowers below it. It is therefore possible to consider that this unit spike of the Mapanieae is coordinate to the true spikelet of *Scirpus*. So that if the staminate flowers of the spikelets of the Mapanieae are lost by reduction, the spikelets of the Mapanieae will become a floral unit of the spikelets of *Scirpus*, and consequently the unit spike will become identical morphologically with the spikelet of *Scirpus* (Fig. 7-C). In drawing my diagram, I assumed the presence of the proto-Cyperaceae, which can give the way either to the Scirpoideae or to the Mapanioideae. This proto-Cyperaceae therefore must have had the spikes consisting of the cymose clusters of hermaphrodite flowers bearing perianth or the metamorphosed structure thereof. Accordingly the proto-Cyperaceae may be taxonomically related to the plants like the Restiaceae or the Juncaceae. In my supposition, the Scirpoideae and the Mapanioideae would have developed independently from this prototypic group by the different ways of the reduction of the floral parts.

### 3. Taxonomic arrangement of the genera of the Cyperaceae laying a stress on those of Asia.

Family **Cyperaceae** St. Hill., Expos. Fam. 1: 62 (1805).

*Flowers* hermaphrodite or unisexual, solitary at axil of glumous bract (=floral

scale), very rarely terminal. *Perianth* none or rudimentary being needle-like, fibrous, plate-like, or as discoid or cup-like *hypogynium*. *Stamens* free, mostly 3. *Pistils* with 1-locular ovary, 2, 3, or 8-fid filiform *stigmas*, and long *style* of which the base frequently enlarged and persistent at the apex of achene as tubercle or beak. *Fruits* of trigonous, lenticular or globose achenes. *Spikelets* consisting of spirally disposed floral scales, many or 1-flowered; sometimes the lowest floral scale metamorphosed into intra spicular prophyll.—Grass-like herbs with various inflorescences. About 3,500 species distributed all over the World at every ecological condition.

A key to genera:

1. Spikelets consisting of a terminal pistillate and axillary staminate flowers; intra-spicular prophylls 2 to a spikelet, always opposite, scale-like or rarely sac-like. (Subfam. MAPANIOIDEAE, tribe **Hypolytreae**)
  2. Leaf-blades and bracts dorsiventrally flattened.
    3. Pistillate flowers naked.
      4. Spikelets consisting of a pair of staminate prophylls and staminate floral scales more than 2.
        5. Staminate floral scales other than prophylls many to a spikelet, both kinds more or less...conformed.....1. *Scirpodendron*
        5. Staminate floral scales other than prophylls 2 to a spikelet; prophylls acute-tipped, prominently scabrous with spinules along keel; floral scales obtuse-tipped glabrous on back. ....2. *Diplasia*
      4. Spikelets consisting of a pair of staminate prophylls only. ....3. *Hypolytrum*
    3. Pistillate flowers with perianth of 3 squamellae. ....4. *Mapania*
  2. Leaf-blades and bracts unifacial.
    6. Staminate flowers 3 to a spikelet; inflorescences corymbose with elongate branches. ....5. *Exocarya*
    6. Staminate flowers many to a spikelet; inflorescences of a single cluster of spikelets.
      7. Inflorescence of many spikelets. ....6. *Lepironia*
      7. Inflorescence of 1 (rarely 2) spikelet(s). ....7. *Chrysithrix*
1. Spikelets consisting of axillary flowers only; intra-spicular prophylls, if present, only one to a spikelet.
  8. Flowers subtended by floral scale, never prophyllate, hermaphrodite or unisexual.
    9. Spikelets many-flowered, broadest at basal part at least below the middle; all floral scales of spikelets flower-bearing, rarely even if the lower few scales are empty, lower floral scales always larger than the upper ones; flowers hermaphrodite as a rule. (Subfam. SCIRPOIDEAE)
      10. Spikelets non-prophyllate, i. e. the lowest floral scale similar in shape with the others; flowers sometimes with rudimentary perianth; floral scales usually spirally imbricated. (Tribe **Scirpeae**)
        11. Pistils not jointed, i. e. stylebases continuing to achene apices.
          12. Floral scales constantly distichous, base decurrent to the wings of rachilla; achenes oblong; styles more or less persistent; inflorescences born at axil of leaves on the upper 2/3 of culms; very aphyllopodic. ....8. *Dulichium*
          12. Floral scales spirally imbricate (very rarely 2-ranked but dorsiventrally flattened), without decurrent base; styles deciduous; inflorescences born on apical part of culms only; other characters not united.



13. Spikelets many-flowered.
  14. Achenes sessile; perianth bristles frequently present. ....9. *Scirpus*
  14. Achenes stipitate always with gynophore. ....10. *Ficinia*
13. Spikelets 1-flowered; floral scales with involved or connate margins. .... 11. *Ascolcpis*
11. Pistils jointed at more or less enlarged base.
  15. Perianth bristles present; culms always 1-spicate, clothed at base with a few bladeless sheaths only. ....12. *Eleocharis*
  15. Perianth absent; other characters not united. ....13. *Fimbristylis*
10. Spikelets prophyllate, i. e. the lowest scale metamorphosed into a prophyll of different form from the other floral scales, empty, more or less 2-keeled; flowers without perianth; floral scales 2-ranked. (Tribe **Cypereae**)..... 14. *Cyperus*
9. Spikelets few-flowered, broadest at or above the middle; only a few floral scales at middle or upper part of spikelets flower-bearing, basal few to several floral scales always empty and conspicuously smaller than the middle and/or the upper ones; flowers hermaphrodite or unisexual. (Subfam. RHYNCHOSPOROIDEAE)
  16. At least one flower of a spikelet hermaphrodite except in dioecious of plants of *Caustis*; achenes without hypogynium but sometimes with perianth bristles (Tribe **Rhynchosporae**).
    17. Fruit-bearing flower(s) born above staminate flower(s) (but see *Caustis*); stigmas 3 or more.
      18. Stamens 3 or less to a flower, styles 3-fid rarely 2-fid. (Subtrib. *Cladiinae*)
        19. Style 3-fid; achenes obtusely triangular in transverse section.
          20. Stylebases continuing to apices of achenes, glabrous.
            21. Achenes drupe-like, not ribbed, glabrous at apex; leaves with dorsiventral blades. ....15. *Cladium*
            21. Achenes hard, 3-ribbed or irregularly rugose; leaves bladeless or with unifacial blade.
              22. Achenes glabrous; perianth bristles broadly scale-like. .... 16. *Lepidosperma*
              22. Achenes pubescent, opaque; perianth bristles needle-like, scabrous. .... 17. *Tricostularia*
  20. Stylebases enlarged, beak-like usually hispid-scabrous.
    23. Inflorescences paniculate.
      24. Stylebases persistent. ....18. *Machaerina*
      24. Stylebases deciduous. ....19. *Mesomelaena*
    23. Inflorescences head-like. ....20. *Gymnoschoenus*
19. Styles 2-fid; achenes oblong with strongly involute margins; beak long, hispid-scabrous, persistent. ....21. *Cyathochaete*
18. Stamens 3 to 6 (rarely up to 22) to a flower; styles 3- to 8-fid. (Subtrib. *Gahniinae*)
  25. Inflorescences paniculate; stylebases beak-like, more or less enlarged.
    26. All floral scales conformed, the flower-bearing ones larger than the lower empty ones.
      27. Perianth bristles present; stigmas usually 3, very rarely up to 6. .... 22. *Tetraria*
      27. Perianth bristles absent; stigmas 4 to 8.

- 28. Stamens less than 6 to a flower; floral scales less than 7 to a spikelet. .... 23. *Caustis*
- 28. Stamens more than 12 to a flower; floral scales more than 14 to a spikelet. .... 24. *Evandra*
- 26. Floral scales dimorphous, i. e. flower-bearing ones obtuse-tipped, shorter than the lower empty ones. .... 25. *Gahnia*
- 25. Inflorescences spicate or capitate; stylebases not enlarged, deciduous.
  - 29. Inflorescences spicate; leaves bladed. .... 26. *Reedia*
  - 29. Inflorescences capitate; leaves bladeless. .... 27. *Arthrostylis*
- 17. Fruit-bearing flower(s) born below staminate or imperfect flower(s); stigmas 3 or 2. (Subtribe *Rhynchosporineae*)
- 30. Stigmas 3; spikelets bilaterally compressed with 2-ranked scales.
  - 31. Stylebases deciduous.
    - 32. Spikelets more than 2-flowered (very rarely 1-flowered); perianth bristles needle-like or absent, very rarely scale-like. .... 28. *Schoenus*
    - 32. Spikelets always 1-flowered; perianth bristles scale-like; dwarf herbs with abbreviated stems. .... 29. *Oreobolus*
  - 31. Stylebases persistent. .... 30. *Carphe*
- 30. Stigmas 2; spikelets less compressed with 2-ranked or spirally imbricated scales. .... 31. *Rhynchospora*
- 16. Flowers unisexual. (Tribe **Sclerieae**)
  - 33. Pistils with discoid or cup-like hypogynium. .... 32. *Scleria*
  - 33. Pistils without any hypogynium.
    - 34. Spikelets consisting of more than 3 floral scales.
      - 35. Perianth bristles none; achenes bony. .... 33. *Lagenocarpus*
      - 35. Perianth bristles of many fibres; achenes not bony, sometimes hairy. .... 34. *Eriospora*
    - 34. Spikelets consisting of 3 floral scales, of which the lower 2 being empty; achenes not bony. .... 35. *Fintelmannia*
- 8. Pistillate flowers subtended by strongly metamorphosed prophyll, which is bottle-shaped or spathaceous; flowers always unisexual, without perianth. (Subfam. CARICOIDEAE, tribe **Cariceae**)
  - 36. Pistillate floral prophylls completely or incompletely split in front, thus spathe-like. .... 37. *Kobresia*
  - 36. Pistillate floral prophylls completely connate, thus sac-like with a small orifice at apex only.
    - 37. Spikelets fascicled; pistillate spikelet surrounded by 2 to 3 staminate spikelets, thus the clusters of spikelets are of contracted corymbs. .... 36. *Hoppia*
    - 37. Spikelets spicately arranged; clusters of spikelets (= spike) usually unisexual, if bisexual, staminate flowers are born on the same rhachis of the pistillate spike never making side branchlet. .... 38. *Carex*

## Subfamily I. MAPANIOIDEAE C. B. Clarke.\*

Tribe 1. **Hypolytreae** Nees in Linnæa 9: 287 (1834).

\* in Thyselst.-Dyer, Fl. Trop. Afr. 8: 268 (1901) & in Kew Bull. Add. Ser. 8, 128 (1908), as *Mapaniae*, corrected by Marloth in Fl. South Afr. 4: 43 (1915).

*Chrysithricheae* Nees in *Linnaea* **9**: 288 (1834)—*Scirpoideae-Hypolytreae-Hypolytrinae* Pax in Engl., Bot. Jahrb. **7**: 305 (1886)—*Caricoideae-Hoppieae-Chrysithrichinae* Pax in Engl., Bot. Jahrb. **7**: 309 (1886)—*Rhynchosporae-Bisboeckelerinae* Engl. & Gilg. Syll. Pflanzenfam. 1 Aufl. 128 (1912)—*Mapanieae* Marloth, Fl. South Afr. **4**: 43 (1915)—*Caricoideae-Bisboeckelerieae* Mattf. in Diels, Syll. Pflanzenf. 11 Aufl. 142 (1936).

**1. Scirpodendron** Zippel ex Kurz in Journ. Asiat. Soc. Beng. **38** (2): 84 (1869).

*Ptychocarya* R. Brown ex Wallich, Catal. Herb. Ind. n. 3538 (1828-49) nomen.

Type: *Scirpodendron costatum* (Thw.) Kurz (= *Sc. Ghaeri* (Gaertn.) Merrill). 1 sp. in Indo-Malaysia, n. Australia and Pacific Islands.

**2. Diplasia** L. C. Richard in Persoon, Synops. Pl. **1**: 70 (1805).

Type: *Diplasia karataefolia* Persoon. 1 sp. in tropical America.

**3. Hypolytrum** L. C. Richard in Pers., Synops. Pl. **1**: 70 (1805); Ohwi, Cyper. Japon. **2**, 168 (1944); Nelmes in Kew Bull. **1955**: 64 (1955).

*Hypaelytrum* Vahl, Enum. Pl. **2**: 283 (1806), p. p.—*Hypolytrum* Humb., Bompl. & Kunth, Nov. Gen. & Sp. Pl. **1**: 218 (1815).—*Beera* P. Beauvois in Lestib., Ess. Fam. Cypér. 43 (1819).—*Tunga* Roxburgh, Fl. Ind. ed. 1, **1**: 187 (1820), p. p.—*Principina*\* Uittien in Rec. Trav. Bot. Néerl. **32**: 282 (1935), syn. nov.—*Hypelytrum* Link, Hort. Berol. Descrip. **1**: 327 (1827).—*Albikia* Presl, Reliq. Haenk. **1**: 184, t. 34 & 35 (1828).

Type: *Hypolytrum latifolium* L. C. Richard. About 40 spp. in tropical regions of both new and old Worlds.

**4. Mapania** Aublet, Pl. Guian. Franc. **1**: 47, t. 17 (1775).

*Halostemma* Wallich, Catal. Herb. Ind. n. 4470 & 4474 (1828-49), nomen.—*Pandano-phyllum* Hasskarl, Catal. Hort. Bogor. 297 (1844), nomen; Kurz in Journ. Asiat. Soc. Beng. **38** (2): 78 (1869),—*Thoracostachyum* Kurz in Journ. Asiat. Soc. Beng. **38** (2): 75 (1869).—*Cephaloscirpus* Kurz in Journ. Asiat. Soc. Beng. **38** (2): 83 (1869).—*Mapaniopsis* C. B. Clarke in Kew Bull. Add. Ser. **8**, 55, (1908), syn. nov.—*Paramapania* Uittien in Rec. Trav. Bot. Néerl. **32**: 186 (1935), syn. nov.

Type: *Mapania sylvatica* Aublet. About 40 spp., pantropic.

As was already suggested (T. Koyama in Bull. Arts & Sci. Div. Ryukyu Univ. **3**, 73-74. 1959), *Thoracostachyum*, *Mapaniopsis* and *Paramapania* can not be separated from *Mapania* as separate genera. All these genera have the same structure of spikelets with slight modifications. In *Paramapania*, the dorsal staminate flower is constantly abortive. This condition suggests its phylogenetical affinity with *Hypolytrum*. In *Thoracostachyum* and *Mapaniopsis*, inflorescences are corymbose with elongated umbel-rays, while in *Mapania s. str.* they are as a rule head-like.

The additional transfers of names caused by this fusion of the genera are:

**Mapania johorensis** (Uittien), comb. nova=*Paramapania johorensis* Uittien in Rec. Trav. Bot. Néerl. **32**: 191 (1935).

**Mapania effusa** (C. B. Clarke), comb. nova=*Mapaniopsis effusa* C. B. Clarke in Kew

\* **Hypolytrum grandis** (Uittien), comb. nova=*Principina grandis* Uittien in Rec. Trav. Bot. Néerl. **32**: 282 (1935).

Bull. Add. Ser. 8, 55 (1908).

**Mapania simplex** (Ridley), comb. nova=*Thoracostachyum simplex* Ridley in Trans. Linn. Soc. 9: 244 (1916).

**Mapania Balansae** (E. G. Camus), comb. nova=*Thoracostachyum Balansae* E. G. Camus in Lecomte, Not. Syst. 1: 252. f. 14 (1910).

**Mapania floribunda** (Nees), comb. nova=*Hypolytrum floribundum* Nees ex Stend., Synops. 2, 132 (1855).

**Mapania parvibractea** (C. B. Clarke), comb. nova=*Hypolytrum parvibractea* C. B. Clarke in Kew. Bull. 1899: 114 (1899).

5. **Exocarya** Benth in Hooker, Icon. Pl. t. 1206 (1877).

Type: *Exocarya sclerioides* (F. v. Mueller) Benth. Monotypic genus in Australia.

6. **Lepironia** L. C. Richard in Pers., Synops. Pl. 1: 70 (1805).

*Chondrachne* R. Brown, Prodr. Fl. Nov. Holl. 1, 220 (1810).—*Chorisandra* R. Brown, Prodr. Fl. Nov. Holl. 1, 221 (1810), syn. nov.—*Choricarpha* Bockeler in Flora 41: 19 (1858).

Type: *Lepironia mucronata* L. C. Richard (= *Lep. articulata* Domin). 5 spp. in Africa, Indo-Malaysia and Australia.

As once suggested by Endlicher, *Chorisandra* is not generically distinct from *Lepironia*. The structure of spikelets is common in both genera. The trigynous pistils and more irregularly disposed squamellae of pistillate flowers in *Chorisandra* show that *Lepironia* is rather a specialized group developed from *Chorisandra*. I treat these two as being in a subgeneric relationship:

**Lepironia** subgen. **Chorisandra** (R. Br.) T. Koyama, stat. nov.—*Chorisandra* R. Br., Prodr. 221 (1810)—*Chorisandra* sect. *Cymbaria* & *Euchorisandra* Benth. & Hook. f., Gen. Pl. 3: 1057 (1883).

Type: *Chorisandra sphaerocephala* R. Br.

**Lepironia cymbaria** (R. Br.) T. Koyama, comb. nova=*Chorisandra cymbaria* R. Br., Prodr. Fl. Nov. Holl. 1, 221 (1810).

**Lepironia sphaerocephala** (R. Br.) T. Koyama, comb. nova=*Chorisandra sphaerocephala* R. Br., Prodr. 1, 221 (1810).

**Lepironia Neesii** T. Koyama, nomen novum=*Chorisandra enodis* Nees in Lehmann, Pl. Preiss. 2: 73 (1846-48), non *Lep. enodis* Miq. (1860).

**Lepironia multiarticulata** (Nees) T. Koyama, comb. nova=*Chorisandra multiarticulata* Nees in Ann. Nat. Hist. 1, 4: 48 (1841).

7. **Chrysithrix** Linn., Mant. Pl. 1: n. 1335 (1767).

Type: *Chrysithrix capensis* Linn. About 4 spp. in South Africa.

## Subfamily II. SCIRPOIDEAE Pax.\*

Tribe 2. **Scirpeae** Nees in Linnaea 9: 289 (1834).

*Ficinieae* Fenzl ex Endlicher, Gen. Pl. 1: 118 (1836)—*Fuireneae* Nees in Mart., Fl. Brasil. 2 (1) 107-108 (1842)—*Scirpoideae-Scirpeae-Scirpiniae* Pax in Engl., Bot.

\* in Engl., Bot. Jahrb. 7: 305 (1886) & in Engl. & Pr., Nat. Pflanzenfam. 1 Aufl. 2 (1): 105 (1889)—*Scirpo-Schoenoideae* C. B. Clarke in Thyselst.-Dyer, Fl. Trop. Afr. 8: 266 (1901) & in Kew Bull. Add. Ser. 8, 93 (1908), as *Scirpo-Schoeneae*.



Jahrb. 7: 307 (1886)—*Dulichieae* Schultze-Motel in Willdenowia 2 (2): 173 (1959), syn. nov.

8. *Dulichum* L. C. Richard in Pers., Synops. Pl. 1: 65 (1805); Kükenth. in Engl., Bot. Jahrb. 75: 487 (1952).

*Websteria* S. H. Wright in Bull. Torrey Bot. Club. 14: 135 (1887).

Type: *Dulichium spathaceum* L. C. Richard (= *D. arundinaceum* Britt.). 1 sp. in north-eastern North America.

For the discussion see the preceeding chapter on p. 46.

9. *Scirpus* Linn., Sp. pl. ed. 1, 47 (1753) & Gen. Pl. ed. 5, 26 (1754); T. Koyama in Journ. Fac. Sci. Univ. Tokyo 3, 7 (6): 282 (1958).

*Hemicarpha* Nees in Edinb. New. Phil. Journ. 17: 263 (1834) & in Wight, Contrib. Bot. Ind., 70 (1834), syn. nov.

*Pentasticha* Turcz. in Bull. Soc. Nat. Moscou 2: 330 (1862).

Type: *Scirpus sylvaticus* Linn. About 250 spp. all over the world.

For the complete synonymy and discussion see T. Koyama l. c. pp. 271-296 (1958). In my opinion, the genus *Hemicarpha* is also a very specialized group of the genus *Scirpus* in a wide meaning. The so-called inner scale of the floral unit of *Hemicarpha* was interpreted by Blasser as a prophyll, but I think it is a more or less reduced floral scale. The floral unit of *Hemicarpha* which consists of two scales and a hermaphrodite flower between the scales, is a one-flowered spikelet. Namely, the inner scale is the floral scale and the dorsal herbaceous scale is a reduced bract on the rhachis. Besides *Hemicarpha*, three more groups, viz. *Blysmus*, *Eriophorum* and *Fuirena* was also merged to the genus *Scirpus* of this amplified sense, so that *Pentasticha*, which is *Fuirena*, should also be added to the synonymy.

10. *Ficinia* Schrader, Anal. Fl. Capens. 43, t. 2 (1832).

*Hemichlaena* Schrader, l. c. 40, t. 3 f. 1 (1832).—*Acrolepis* Schrader, l. c. 42, t. 2 f. 5 (1832).—*Pleurachne* Schrader, l. c. 47, t. 4 (1832).—*Schoenidium* Nees in Linnaea 9: 291 (1834).—*Sickmannia* Nees in Linnaea 9: 292 (1834).—*Chamaeziphium* Hochst. in Flora 18: 102 (1844).

Type: *Ficinia truncata* Schrader. About 50 spp. in South Africa.

11. *Ascolepis* Nees ex Steudel, Synops. Pl. Glumac. 2: 105 (1855).

*Flatylepis* Kunth, Enum. Pl. 2: 269 (1837), non L. C. Richard (1805).

Type: *Ascolepis ericauloides* Steudel. Tropical and South Africa, Madagascar.

This is very characteristic by the inner scale of the spikelets, which is born between achene and its bract scale but incloses the achene with its broad margins completely or incompletely connate. Bentham, regarding the inner scales a pair of prophyll acales, placed *Ascolepis* in the tribe Hypolytreae, while C. B. Clarke treated it as an ally of *Lipocarpha* of Scirpeae. I only examined several herbarium specimens of *Ascolepis* spp., but I am unable to get any living material for an atomical examination. So far as the external aspects are concerned, I rather agree with Clarke, however, I here tentatively place it in the tribe Scirpeae untill the inner scale of *Ascolepis* is morphologically worked out.

**12. Eleocharis** R. Brown, Prodr. Fl. Nov. Holl. 1, 224 (1810); Ohwi, Cyper. Japon. 2, 29 (1944). [Nom. conserv.].

*Trichophyllum* Ehrhart, Beitr. 4: 147 (1789).—*Bulbostylis* Steven in Mém. Soc. Nat. Moscou 5: 355 (1813), non Kunth (1837).—*Limnochoa* P. Beauvois, Ess. Fam. Cypér. 41 (1819), non Nees (1834).—*Chaetocyperus* Nees in Linnaea 9: 289 (1834).—*Scirpidium* Nees in Linnaea 9: 283 (1834).—*Eleogenus* Nees in Linnaea 9: 294 (1834).—*Limnochloa* Nees in Linnaea 9: 294 (1834), non Beauv. ex Lestib. (1819).—*Limnocharis* Kunth, Enum. Pl. 2: 153 (1837).

Type: *Eleocharis palustris* (Linn.) Römer & Schultes. About 120 spp. all over the world.

This uniform genus differs from the section *Isolepis* of the genus *Scirpus* by always conspicuous stylebases and truly terminal spikelet with a small scale-like bract. I separated *Eleocharis* generically from *Scirpus* also on the cytological basis. The chromosomes of *Eleocharis* are strikingly large in shape and inconsiderably low numbers. The morphological characters prove that *Eleocharis* is in an ultimate condition descended from *Isolepis* or *Eleogiton* of Scirpeae, while the chromosomal data suggest that *Eleocharis* is rather primitive in the family. From these evidences *Eleocharis* is phylogenetically a specialized group on a lower side branch of Scirpeae the evolutionary tree.

**13. Fimbristylis** Vahl, Enum. Pl. 2: 285 (1806); Ohwi, Cyper. Japon. 2, 52 (1944). [Nom. conserv.].

*Iria* L. C. Richard in Persoon, Synops. Pl. 1: 65 (1805).—*Abildgaadia* Vahl, Enum. Pl. 2: 296 (1806).—*Echinolytrum* Desv. in Journ. de Bot. 1: 20 (1808).—*Trichelostylis* P. Beauv. in Lestib., Ess. Fam. Cypér. 40 (1819).—*Stenophyllus* Rafinesque, Neogenyt. 4 (1825).—*Gussonea* Presl, Reliq. Haenk. 1: 183, t. 183, t. 33 (1828).—*Pogonostylis* Bertol., Fl. Ital. 1: 312 (1833).—*Bulbostylis* Kunth, Enum. Pl. 2: 205 (1837).—*Oncostylis* Nees in Mart., Fl. Brasil. 2 (1): 80 (1842).—*Miscospora* Böckeler in Flora 43: 113 (1860).—*Trachstylis* S. T. Blake in Proc. Roy. Soc. Queensl. 48: 89 (1937).—*Tylocarya* Nelmes in Kew Bull. 1949: 139 (1949).

Type: *Fimbristylis dichotoma* (Linn.) Vahl. About 350 spp. in tropical and temperate regions of both hemispheres.

This is not the first time to include *Bulbostylis* in the genus *Fimbristylis* sensu lato. In Gray's Manual of Botany, ed. 1, *Bulbostylis capillaris* was placed in the section *Oncostylis* Bentham as *Fimbristylis capillaris* Gray. The section is based on the genus *Oncostylis* Nees, which is synonymous with *Bulbostylis* Kunth. The morphological difference between *Bulbostylis* and *Fimbristylis* is the duration of stylebases only. They are more or less thick and deciduous in *Fimbristylis*, and persistent in *Bulbostylis*. Though such persistent stylebases can be seen also in *Eleocharis*, this genus is cytologically conspicuously discriminable from *Scirpus* with deciduous stylebase. However, *Bulbostylis* and *Fimbristylis* are cytologically the same, having same basic number and similar size of chromosomes, in addition that the characters of achenes and spikelets show very close affinity between the two. The identity of the genus *Tylocarya* was fully discussed by Kern (in Act. Bot. Neerl. 7: 798-800. 1958).

Tribe 3. **Cypereae** Nees in Linnaea 9: 982 (1834).

*Scirpeae-Cyperinae* Pax in Engl., Bot. Jahrb. **7**: 306 (1886)—*Hypolytreae-Lipocarphinae* Pax in Engl., Bot. Jahrb. **7**: 305 (1886)—*Kyllingieae* Chermезon, Cat. Pl. Madag. **7** (1931).

**14. Cyperus** Linn., Sp. Pl. ed. 1, 44 (1753) & Gen. Pl. ed. 5, (1754); Kükenth., Cyperac.-Cypereae 41 (1936); Ohwi, Cyper. Japon. **2**, 123 (1944).

*Kyllinga* Rottb., Descr. & Icon. Rar. Pl. **12** (1773).—*Remirea* Aublet, Hist. Pl. Guian. Franc. **1**: **44** (1775), syn. nov.—*Mariscus* Geartn., Fruct. & Sam. Pl. **1**: 12 (1788).—*Opetiola* Gaertn., l. c. **14**, t. 2 f. 8 (1788).—*Miegia* Schreb., Gen. **2**: 786 (1791), syn. nov.—*Adupla* Bosc. in J.St.-Hillaire, Expos. Fam. **1**: 65 (1805).—*Hypaelytrum* Vahl, Enum. Pl. **2**: 283 (1806), p. p.—*Pycnus* P. Beauv., Fl. d'Oware **2**: 48, t. 86 (1807).—*Papyrus* Willd. in Abhandl. Akad. Berlin **1812**: 70 (1816).—*Lipocarpa* R. Brown in Tucky, Narr. Exped. Congo 459 (1818), **syn.** nov.—*Dichostylis* P. Beauv. in Lestib., Ess. Fam. Cypér. **39** (1819).—*Torreya* & *Distimus* Rafinesque in Journ. Phys. **89**: 105 (1819).—*Epiphytistis* Trinius, Fund. Agrost. **97** (1820).—*Tunga* Roxb., Fl. Ind. ed. 1, **1**: 183 (1820), p. p.—*Hedychloe* Rafinesque in Ann. Nat. **16** (1820).—*Torulinium* Desv. in Hamilt., Prodr. Pl. Ind. Occid. **15** (1825).—*Pycnus* Juss., Dictionaire **40**: 194 (1826).—*Courtoisia* Nees in Linnaea **9**: 286 (1834).—*Anosporum* Nees in Linnaea **9**: 287 (1834).—*Diclidium* Schrader ex Nees in Mart., Fl. Brasil. **2** (1): 51 (1842).—*Galilea* Parl., Fl. Palerm. **1**: 297 (1845).—*Hydroschoenus* Zollinger & Moritzi, Syst. Verz. Pflanz. Zolling. **95** (1846).—*Sorostachys*, *Atomostylis* & *Cyplelepis* Steudel in Flora **33**: 229 (1850).—*Pterocyperus* Opiz, Seznam. Kvet. České **80** (1852).—*Borabora* Steud., Synops. Pl. Gl. **2**: 71 (1855).—*Lyplelepis* Steud., l. c. **2**: 130 (1855).—*Trentepohlia* Bockeler in Bot. Zeit. **16**: 249 (1858).—*Cylindrolepis* Bockeler in Bot. Centralbl. **39**: 73 (1889).—*Juncellus* (C. B. Clarke) C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 594 (1893).—*Eucyperus* (C. B. Clarke) Rikli in Pringsh., Jahrb. für Wiss. Bot. **27**: 568 (1895).—*Chlorocyperus* Rikli, l. c. **563** (1895).—*Duval-Jouvea* Palla in Koch, Synops. Pl. ed. 3, **2**: 2555 (1905).—*Acorellus* Palla, l. c. **2557** (1905).—*Sphaeromaris* E. G. Camus in Lecomte, Fl. Génér. Indo-Chine **7**: 79 (1912).—*Queenslandiella* Domin in Bibl. Bot. **20**, Heft 85, 415 (1915).—*Mariscopsis* Chermезon in Bull. Mus. Paris. **25**: 60 (1919).

Type: *Cyperus esculentus* Linn. About 650 spp. all over the world except in the arctic and antarctic regions.

As was fully discussed in the previous chapters, *Remirea* and *Lipocarpa* are here united to the genus *Cyperus*. The relating transfers of names were published separately in Bot. Mag. Tokyo **73**: 438 (1960). For the subdivision of the genus see the Part II, p. 119.

#### Subfamily III. RHYNCHOPOROIDEAE Aschers. & Graebn.\*

Tribe 4. **Rhynchosporae** Nees in Linnaea **9**: 294 (1834).

Subtribe (1). **Cladiinae** T. Koyama, subtrib. novus.

Trib. *Cladieae* Nees in Linnaea **9**: 297 (1834)—Flores perfecti super flores musculos nascentes; stamina 3 vel pauca ex unico flore; stigmata 3-fida. Typus: *Cladium* P. Br.

**15. Cladium** P. Browne, Hist. Jamaica 114 (1756); Crantz, Instit. **1**: 362 (1766); Kükenth. in Fedde, Repert. **51**: 7 (1942); T. Koyama in Bot. Mag. Tokyo **69**: 61 (1956).

\* Synops. Mitteleur. Fl. **2** (2): 339 (1904)—*Scirpo-Schoenoideae* C. B. Clarke, l. c. p. p.

*Mariscus* Haller ex Zinn, Catal. Pl. Hort. Götting. 79 (1757), non Gaertn. (1788).

Type: *Cladium jamaicense* Crantz. 4 spp. in North America, Eurasia and Pacific Islands.

**16. *Lepidosperma*** Labillardière, Nov. Holland. Pl. 1: 14 (1804); Kükenth. in Fedde, Rept. 50: 26 (1941).

*Vauthiera* A. Richard in d'Urville, Voy. Astrol. Bot. 1: 107, t. 20 (1832).

Type: *Lepidosperma elatius* Labill. More than 40 spp. in Australia, New Zealand and Malaysia.

The genus *Lepidosperma* is very closely related to the genus *Machaerina*, from which it can be distinguished by hardly thickened stylebase and the perianth bristles usually broadly deltoid-subulate and shorter than the achene. In *Machaerina*, perianth bristles are needle-like and scabrous with spinules if present.

**17. *Tricostularia*** Nees in Lehmann, Pugill. 8: 51 (1844); Kükenth. in Fedde, Rept. 53: 215 (1944).

Type: *Tricostularia compressa* Nees. 3 spp. in Australia.

**18. *Machaerina*** Vahl. Enum. Pl. 2: 238 (1806); T. Koyama in Bot. Mag. Tokyo 69: 61 (1956).

*Trasi* P. Beauvois in Lestib., Ess. Fam. Cypér. 32 (1819).—*Baumea* Gaudichaud in Freycinet, Voy. Bot 416 (1826).—*Vincentia* Gaudichaud in Freycinet, l. c. 417 (1826).—*Chapelliera* Nees in Linnaea 9: 298 (1834).—*Trachyrhynchium* Nees in Nov. Act. Nat. Curios 19, Suppl. 1: 113 (1843).

Type: *Machaerina restioides* Vahl. About 48 spp. chiefly in the tropics.

This genus was included in the genus *Cladium* until I divided the *Cladium* sensu lato into the two genera, one including *Cladium* sensu stricto and another consisting of *Machaerina*, *Baumea* and *Vincentia*. As was fully discussed by me (in Bot. Mag. Tokyo 69: 59-62. 1956) and also by Kern (in Act. Bot. Neerl. 8: 263-268. 1959), *Machaerina* appears to be quite distinct from *Cladium* not only by the hard achenes crowned by a conspicuous stylebase but also by the unifacial nature of blades. Thus it comes rather near to *Lepidosperma* from which it is also different in the needle-like perianth bristles and conspicuously beak-like stylebases. It is of interest that the pollen grains of *Machaerina* are of the polyphorate type, which has not been seen in any cyperaceous genus other than *Machaerina*.

**19. *Mesomelaena*** Nees in Lehmann, Pl. Preiss. 2: 88 (1846-47); Kükenth. in Fedde, Rept. 48: 52 (1940).

Type: *Mesomelaena stygia* Nees. 2 spp. in Australia.

**20. *Gymnoschoenus*** Nees in Ann. Nat. Hist. Ser. 1, 4: 47 (1841); Kükenth. in Fedde, Rept. 48: 58 (1940).

Type: *Gymnoschoenus anceps* Nees. 2 spp. in Australia.

**21. *Cyathochaete*** Nees in Lehmann, Pl. Preiss. 2: 86 (1846-47); Kükenth. in Engl. Bot. Jahrb. 75: 491 (1952).



*Tetralepis* Steudel, Synops. Pl. Glumac. 2: 159 (1855).

Type: *Cyathochaete diandra* Nees. About. 3 spp. in Australia.

Kükenth placed this genus in the Rhynchosporaeae sensu stricto because of digynous pistils. In *Cyathochaete*, however the fruit-bearing flower is born above the staminate flowers, so that it comes closer to Cladiinae rather than Rhynchosporinae. In my opinion the state of the reduction of spikelets is more important than the number of carpels in the Rhynchosporoid genera.

Subtribe (2). **Gahninae** T. Koyama, subtrib. nov.

Trib. *Gahninae* Pax in Engl., Bot. Jahrb. 7: 308 (1886)—Flores hermaphroditi super flores masculos imperfectosve nascentes; stamina 3 ad 6 raro usque 22 ex unico flore; styli 3- ad 8-fidi; squamae florum interdum heteromorphae. Typus: *Gahnia* Forst.

**22. Tetraria** P. Beauvois in Mém. Instit. Paris 1812 (2): 54 (1816); Kükenth. in Fedde, Repert. 48: 203 (1940).

*Lepisia* Presl, Symbol. Bot. 1: 9, t. 5 (1830).—*Trichoballia* Presl, Symbol. Bot. 1: 9 (1830). *Sclerochaetium* Nees in Linnaea 7: 511 (1832).—*Elynanthus* Nees in Linnaea 7: 520 (1832). *Schoenopsis* Nees in Linnaea 7: 528 (1832).—*Buekia* Nees in Linnaea 9: 300 (1834).—*Cyathocoma* Nees in Linnaea 9: 300 (1834).—*Aulacorhynchus* Nees in Linnaea 9: 305 (1834). *deleria* Kunth, Enum. Pl. 2: 310 (1837).—*Macrochaetium* Steudel, Synops. Pl. Glum. 2: 159 (1855).—*Decalepis* Böckeler in Engl., Bot. Jahrb. 5: 509 (1884).—*Boeckeleria* Th. Durand, Index Gen. Phanerog. 504 (1888).—*Epischoenus* C. B. Clarke in Durand & Schinz, Consp. Fl. Afr. 5: 657 (1895).—*Costularia* C. B. Clarke in Durand & Schinz, Consp. Fl. Afr. 5: 658 (1895), syn. nov.—*Tetrariopsis* C. B. Clarke ex Diels & Pritzel in Engl., Bot. Jahrb. 35: 81 (1950).—*Lophoschoenus* Stapf in Journ. Linn. Soc. 42: 177 (1914), syn. nov.

Type: *Tetraria Thuarii* P. Beauvois. Nearly 60 spp. chiefly in Africa, partially in New Caledonia and Malaysia.

In my observation, *Tetraria* and *Costularia* are congeneric. In typical *Tetraria*, floral scales are more irregularly 2-ranked, perianth bristles are more slender, and achenes are more obtusely trigonous, as compared with *Costularia*. These characters, however, are not sufficient to make generic discrimination, and when *Epischoenus* and *Elynanthus* are included in *Tetraria* as subgenera thereof, *Costularia* should also be better treated as a subdivision of *Tetraria*. The following are the necessary transfers of names related to this reduction of *Costularia*.

**Tetraria arundinacea** (Forst. fil.) T. Koyama, comb. nova=*Schoenus arundinacea* Forster, fil. (Fl. Ins. Austr. Prodr. 89 (1786), nomen) ex Vahl, Enum. Pl. 2: 220 (1806).

**Tetraria brevifolia** (Chermezev) T. Koyama, comb. nova=*Costularia brevifolia* Chermezev in Bull. Soc. Bot. France 69: 723 (1922).

**Tetraria chamaedendron** (Guillaum.) T. Koyama, comb. nova=*Lophoschoenus chamaedendron* Guillaumin in Bull. Mus. Nation. Hist. Nat. (Paris) 2<sup>e</sup> sér., 6: 199 (1934).

**Tetraria comosa** (C. B. Clarke) T. Koyama, comb. nova=*Schoenus comosus* C. B. Clarke in Kew Bull. Add. Ser. 8, 44 (1908).

**Tetraria Daenikeri** (Kükenth.) T. Koyama, comb. nova=*Costularia Daenikeri* Kükenth. In Fedde, Repert. 44: 31 (1938).

**Tetraria elongata** (Kunth) T. Koyama, comb. nova=*Asterochaete elongata* Kunth, Enum.

Pl. 2: 312 (1837).

**Tetraria falcifolia** (Däniker) T. Koyama, comb. nova=*Lophoschoenus falcifolia* Däniker, in Vierteljahrsschr. Naturf. Gesel. Zürich 77, Beibl. Nr. 19, 77 (1932).

**Tetraria fragilis** (Däniker) T. Koyama, comb. nova=*Lophoschoenus fragilis* Däniker, l. c. 78 (1932).

**Tetraria Hornei** (C. B. Clarke) T. Koyama, comb. nova=*Schoenus Hornei* C. B. Clarke in Dur. & Schinz, Consp. Fl. Afr. 5: 657 (1895).

**Tetraria laxa** (Chermezev) T. Koyama, comb. nova=*Costularia laxa* Chermezev in Bull. Soc. Bot. France 69: 723 (1922).

**Tetraria leucocarpa** (Ridley) T. Koyama, comb. nova=*Rhynchospora leucocarpa* Ridley in Journ. Linn. Soc. 20: 335 (1884).

**Tetraria Melleri** (Baker) T. Koyama, comb. nova=*Cladium Melleri* Baker in Journ. Linn. Soc. 21: 451 (1885).

**Tetraria natalensis** (C. B. Clarke) T. Koyama, comb. nova=*Costularia natalensis* C. B. Clarke in Dur. & Schinz, Consp. Fl. Afr. 5: 658 (1895).

**Tetraria pantopoda** (Baker) T. Koyama, comb. nova=*Cladium pantopodum* Baker in Journ. Linn. Soc. 21: 451 (1885).

**Tetraria purpurea** (Chermezev) T. Koyama, comb. nova=*Costularia purpurea* Chermezev in Bull. Soc. Bot. Fr. 69: 722 (1922).

**Tetraria stagnalis** (Däniker) T. Koyama, comb. nova=*Lophoschoenus stagnalis* Däniker in Vierteljahrsschr. Naturf. Gesel. Zürich. 77, Beibl. Nr. 19, 79 (1932).

**Tetraria Urvilleana** (Gaudich. ex Bockeler) T. Koyama, comb. nova=*Carpha Urvilleana* Gaudichaud (ex Nees in Linnaea 9: 300 (1834) nomen) ex Bockeler in Linnaea 38: 272 (1874).

**Tetraria xyridoides** (Däniker) T. Koyama, comb. nova=*Schoenus xyridoides* Däniker in Vierteljahrsschr. l. c. 81 (1932).

23. **Caustis** R. Br., Prodr. Fl. Nov. Holl. 1, 239 (1810); Kükenth. in Fedde, Repert. 51: 91 (1841).

*Eurostorhiza* Steudel, Synops. Pl. Glum. 2: 265 (1855).

Type: *Caustis flexuosa* R. Br. 7 spp. in Australia.

24. **Evandra** R. Br., Prodr. Fl. Nov. Holl. 1, 239 (1810); Kükenth. in Fedde, Repert. 53: 190 (1944).

Type: *Evandra aristata* R. Br. 2 spp. in Australia.

25. **Gahnia** Forster, Char. Gen. Pl. 51, t. 26 (1776); Kükenth. in Fedde, Repert. 51: 62 (1941); Ohwi, Cyper. Japon. 2, 13 (1944).

*Lampocarya* R. Br. Prodr. 1, 238 (1810), later spelled as *Lamprocarya* Nees in Linnaea 9: 301 (1834).—*Morelotia* Gaudichaud in Freyc., Voy. Bot. 416, t. 28 (1826).—*Epiandria* Presl in Oken, Isis Bot. Beech. Voy. 3: 98 (1841).—*Didymonema* Presl, Symb. Bot. 1: 5, t. 3 (1832).—*Melachne* Schrader ex Römer & Schuet., Syst. Veg. 7 (2): 85 (1830).—*Psittacoschoenus* Nees in Lehmann, Pl. Preiss. 2: 87 (1846-47).—*Phacellathus* Steudel, Synops. 2: 153 (1855).—*Hexalepis* Böckl. in Flora 58: (1875).

Type: *Gahnia schoenoides* G. Forster. Over 30 spp. in Australia, New Zealand, Pacific Islands, Malaysia, s. e. Asia.

A distinct genus in having heteromorphous floral scales.

26. **Reedia** F. v. Mueller, Fragm. Phytogr. Austral. 1: 239 (1859); Kükenth. in

Fedde, Repert. **51**: 212 (1941).

Type: *Reedia spathacea* F. v. Mueller. A monotypic genus in Australia.

- 27. *Arthrostylis*** R. Br., Prodr. Fl. Nov. Holl. 1, 229 (1810); Kükenth. in Fedde, Repert. **53**: 195 (1944).

*Actinoschoenus* Benth. & Hook. f., Icon Pl. Ser. 3, **4**: 33 (1881).

Type: *Arthrostylis aphylla* R. Br. 4 spp. in Australia, India and tropical Africa.

The Indo-African species somewhat differ from typical *Arthrostylis* in having always 3 stamens (up to 6 in Australian one), so that they were once treated as of a separate genus, *Actinoschoenus*.

Subtribe (3). **Rhynchosporinae** T. Koyama, subtrib. nov.

*Rhynchosporeae* Nees, sensu stricto—*Schoeneae* C. B. Clarke in Dyer, Fl. Trop. Afr. **8**: 267 (1901) & in Kew Bull. Add. Ser. **8**, 122 (1908), as *Schoeniae*, syn. nov. —Flores hermaphroditi infra flores masculos imperfectosve nascentes; squamae florum aut spiraliter aut distiche dispositae; atigmata 2 vel 3; nuces lenticulares vel trigonae; stamina 3 vel pauciora.

Typus: *Rhynchospora* Vahl.

I do not separate *Schoeneae* from *Rhynchosporeae* s. str. *Schoeneae* was first accommodated to such genera having trigynous pistils and 2-ranked floral scales. However, as for the arrangement of scales, the sections *Haplostylis* and *Sphaeroschoenus* of *Rhynchospora* have also 2-ranked scales. The number of stylearms is of less value to make a classification of major groups of the Cyperaceae.

- 28. *Schoenus*** Linn., Sp. Pl. ed. 1, 42 (1753) ex parte & Gen. Pl. ed. 5, 26 (1754), etiam p.p.; Kükenth. in Fedde, Repert. **44**: 15 (1938); Ohwi, Cyper. Japon. **2**, 26 (1944).

*Chaetospora* R. Br., Prodr. Fl. Nov. Holl. 232 (1810).—*Streflidia* Link, Hort. Berol. Descript. **1**: 276 (1827).—*Heleothis* & *Isoschoenus* Nees in Ann. Nat. Hist. Ser. 1, **4**: 45 (1841).—*Gymnochaeta* Steudel, Synops. **2**: 156 (1855).—*Cyclocampe* Steudel, Synops. **2**: 156 (1855).—*Cyclocarpa* Miquel, Fl. Ind. Batav. **3**: 339 (1859).—*Lepidospora* F. v. Mueller, Fragm. Phytogr. Austral. **9**: 34, in annot. (1875).—*Microschoenus* C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 75 (1894).—*Neolophocarpus* E. G. Camus in Lecomte, Fl. Génér. Indo-Chine **7**: 148 (1912).—

Type: *Schoenus nigricans* Linn. About 85 spp. nearly all over the Old World and Oceania.

- 29. *Oreobolus*** R. Br., Prodr. Fl. Nov. Holl. 1, 235 (1810); Kükenth. in Fedde, Repert. **48**: 64 (1940).

Type: *Oreobolus pumilio* R. Brown. 6 spp. in Australia and Malaysia.

A small genus of pygmaeous species. The spikelets of the genus are always one-flowered, so that we are unable to determine whether the flowers were reduced from the apical part of spikelets actually. Its strictly 2-ranked scales and leaves, however, suggest its alliance with *Schoenus*. It is also of interest that the more or less perianth-like hypogynous bristles such as those of *Oreobolus* rarely occur in *Schoenus*. Though *Lepidosperma* commonly has such perianth bristles, no close relationship between these latter two can be seen in all the other characters.

**30. *Carpha*** Banks & Solander ex R. Brown, Prodr. Fl. Nov. Holl. 1, 230 (1810), ex parte; Kükenth. in Fedde, Repert. 47: 108 (1939); Ohwi, Cyper. Japon. 2, 25 (1944).

*Ecklonia* Steudel in Flora 12: 138 (1829), later spelled as *Ecklonea* by C. B. Clarke in Dur. & Schinz, Consp. Fl. Afr. 5: 656 (1895).—*Asterochaete* Nees in Linnaea 9: 300 (1834).—*Trianoptiles* Fenzl ex Endlicher, Gen. Pl. 113 (1836-40).—*Oreograstis* K. Schum. in Engl., Pflanzenw. Ostaf. C: 127 (1895).

Type: *Carpha alpina* R. Br. Nearly 10 spp. in Australia, Malaysia, Africa.

**31. *Rhynchospora*** Vahl, Enum. Pl. 2: 229 (1806), as *Rynchospora*, corrected by Willdenow, Enum. Pl. 71 (1809); Ohwi, Cyper. Japon. 2, 15 (1944); Kükenth. in Engl., Bot. Jahrb. 74: 386 (1949). [nom. conserv.]

*Phaeocephalum* Ehrh., Beitr 5: 146 (1789).—*Dichromena* Michaux, Fl. Boreal.-Amer. 1: 37 (1803).—*Dichroma* Persoon, Synops. Pl. 1: 57 (1805).—*Triodon* L. C. Richard in Persoon, Synops. Pl. 1: 60 (1805).—*Sermodon* P. Beauvois in Lestib., Ess. Fam. Cypér. 27 (1819).—*Zosterospermum* P. Beauvois in Lestib., Ess. Fam. Cypér. 28 (1819).—*Pleurostachys* Brongniart in Duperr., Voy. Bot. Coq. 172 (1829); Kükenth. in Engl. Bot. Jahrb. 75: 456 (1952).—*Calyptrostylis*, *Mitrospora*, *Cephaloschoenus* & *Morisia* Nees in Linnaea 9: 295 (1834).—*Ceratoschoenus*, *Diplochaete* & *Haloschoenus* Nees in Linnaea 9: 296 (1834).—*Echinoschoenus* Nees & Meyen ex Nees in Linnaea 9: 297 (1834).—*Lonchostylis* Torrey in Ann. Lyc. N. Y. 3: 370 (1836).—*Exphaloschoenus* & *Leptoschoenus* Nees in Hook., Journ. Bot. 2: 393 (1840).—*Ephippiorhynchium* Nees in Mart., Fl. Brasil. 2 (1): 110 (1842).—*Pachymitra* Nees in Mart., l. c. 115 (1842).—*Asteroschoenus* Nees in Mart., l. c. 124 (1842).—*Ptilochaete* Nees in Mart., l. c. 147 (1842).—*Hygrocharis* Nees in Mart., l. c. 147, in annotat. (1842).—*Sphaeroschoenus* Nees in Nov. Act. Nat. Curios 19, Suppl. 1: 97 (1843).—*Ptilosciadium* Steudel, Synops. Pl. Glum. 2: 149 (1855).—*Calyptrolepis* Steudel, l. c. 151 (1855).—*Trichochaeta* Steudel, l. c. 155 (1855).—*Kleistocalyx* Steudel, l. c. 229 (1855).

Type: *Rhynchospora alba* (Linn.) Vahl. Over 90 spp. in tropical and warm regions of all the world, especially abundant in new world tropics.

Tribe 5. **Sclerieae** Nees in Linnaea 9: 302 (1934).

*Cryptangieae* Benth. & Hook. f., Gen. Pl. 3: 1042 (1883)—Subfam. *Sclerioideae* C. B. Clarke in Kew Bull. Add. Ser. 8, 138 (1908).

**32. *Scleria*** Berginus in Vetensk. Akad. Nya Handl. Stockholm 26: 142, t. 4 & 5 (1765); Ohwi, Cyper. Japon. 2, 4 (1944).

*Diaphora* Loureiro, Fl. Cochindh. 578 (1790).—*Diplacrum* R. Br., Prodr. Fl. Nov. Holl. 1, 241 (1810).—*Becquerelia* Brongn. in Duperr., Voy. Coq. Bot. 161, t. 27 (1828).—*Hypoporum* Nees in Linnaea 9: 303 (1834).—*Cylindropus* Nees in Linnaea 9: 303 (1834).—*Pteroscleria* Nees in Linnaea 9: 303 (1834).—*Anerma* Schrader ex Nees in Mart., Fl. Brasil. 2 (1): 170 (1842).—*Chondrolomia* Nees in Mart., Fl. Brasil. 2 (1): 173 (1842).—*Hymenolytrum* Schrader ex Nees in Mart., Fl. Brasil. 2 (1): 147, t. 22 (1842).—*Macrolomia* Schrader ex Nees, l. c. 2 (1): 181, t. 24 (1842).—*Mastigoscleria* Nees in Mart., Fl. Brasil. 2 (1): 177 (1842).—*Osmoscleria* Nees, l. c. 180 (1842).—*Ophrydium* Schrader ex Nees in Mart., Fl. Brasil. 2 (1): 183 (1842).—*Ophryscleria* Nees in Mart., Fl. Brasil. 2 (1): 182, t. 25 (1842).—*Schizolepis* Schrader ex Nees in Mart., Fl. Brasil. 2 (1): 169, t. 25 (1842).—*Trachylomia* Schrader ex Nees, l. c. 174 (1842).—*Diploscyphus* Liebm. in Vidensk. Selsk. Skr. 5, 2: 262 (1850).—



*Sphaeropus* Bückeler in Flora **41**: 89 (1873).

Type: *Scleria mitis* Bergius. About 150 spp. in the tropics and subtropics of both hemispheres.

Among the many groups of *Scleria* allies which were described as genera by Nees and a few others, *Diplacrum* and *Pteroscleria* sometimes have been separated generically from the genus *Scleria* of a narrow meaning, as done by S. T. Blake (in Journ. Arn. Arb. **45**: 234. 1954). As was also pointed out by Blake, in *Diplacrum* and *Pteroscleria*, staminate spikelets are unexceptionally born below the pistillate one, while in *Scleria*, staminate spikelets are born above the pistillate one when the spikelets are unisexual. However, as to the structure of spikelets, there is no fundamental difference between the two, and I am unable to keep either of the two as generically distinct from *Scleria*. Further, though Blake separated *Pteroscleria* from *Diplacrum* also as a separate genus (l. c.), these two are mostly the same except for the winged keels and non-toothed apices of the scales in *Pteroscleria*. These differences appear to be sectional in my concept. In any way, *Diplacrum* is phylogenetically a more developed group than the *Scleria* sensu stricto by the definitely unisexual spikelets aggregated in a head and the floral scales which fall off tightly inclosing the achenes.

**33. Lagenocarpus** Nees in Linnaea **9**: 304 (1834).

*Anogyna* Nees in Hook., Journ. Bot. **2**: 395 (1840).—*Cryptangium* Schrader ex Nees in Mart., Fl. Brasil. **2** (1): 163, t. 19 (1842), syn. nov.

Type: *Lagenocarpus guianensis* Nees. About 20 spp. in tropical America.

*Lagenocarpus* and *Cryptangium* are not generically distinct from one another. Both differ from *Scleria* by the achenes without hypogynium and from *Eriospora* in lacking the hypogynous bristles. The genus *Fintelmannia* is distinguishable from *Lagenocarpus* and *Eriospora* by the spikelets always consisting of 3 floral scales. Because I was able to investigate these genera only through a very small number of herbarium specimens only, I am unable to state more of them, but it is true that they are extremely closely allied to each other.

**34. Fintelmannia** Kunth, Enum. Pl. **2**: 362 (1837).

'*Trilepis* Nees': Nees in Mart., Fl. Brazil. **2** (1): 197, t. 29 (1842).

Type: *Fintelmannia restioides* Kunth. According to C. B. Clarke, 4 spp. in tropical South America.

**35. Eriospora** Hochst. ex A. Richard, Tent. Fl. Abyss. **2**: 508 (1851).

Type: *Eriospora abyssinica* A. Richard. 7 spp. in tropical Africa and Madagascar Is.

Subfamily IV. CARICOIDEAE Pax.\*

Tribe 6. **Cariceae** Nees in Linnaea **9**: 305 (1834).

*Elyneae* Nees in Linnaea **9**: 304 (1834)—*Hoppieae* Pax in Engl., Bot. Jahrb.

\* in Engl., Bot. Jahrb. **7**: 307 (1886) & in Engl. & Pr., Nat. Pflanzenfam. 1 Aufl. **2** (1): 104 (1889).

7: 308 (1886)—*Hoppieae-Hoppiinae* Pax, l. c. 7: 309 (1886).

**36. *Hoppia*** Nees in Mart., Fl. Brasil. 2 (1): 199, t. 30 (1842).

Type: *Hoppia irrigata* Nees. A few species in tropical South America.

Bentham, considering that the utricles of *Hoppia* consist of fused 3 floral scales, placed it near the genera *Scleria* and *Fintelmannia*. On the other hand, however, its achenes and vegetative parts exhibit the nature of *Carex*. I put *Hoppia* tentatively in the *Cariceae* until the anatomical study of the utricles of *Hoppia* will give a decision.

**37. *Kobresia*** Willdenow, Sp. Pl. 4: 205 (1805).

*Elyna* Schrader, Fl. Germ. 1: 155 (1806).—*Cobresia* Persoon, Synops. Pl. 2: 534 (1807). *Floelichia* Wulf. in Römer & Schultes, Syst. Veg. 2: 156 (1817).—*Schoenoxiphium* Nees in Linnaea 7: 531 (1832), syn. nov.—*Trilepis* Nees in Edinb. New Philos. Journ. 17: 267 (1834). *Triticoides* Griff., Itiner. Notes 140 (1848).—*Cobria* St. Lag in Ann. Soc. Bot. Lyon 8: 175 (1881).—*Hemicarex* Bentham in Journ. Linn. Soc. 18: 367 (1881).

Type: *Kobresia myosuroides* (Vill.) Fiori & Paoletti (= *Kobresia scirpina* Willd.; *Elyna spicata* Schrader). About 35 spp, in Africa, Eurasia and N. America.

The generic name was based on P. de Cobres, so that Persoon changed the spelling as *Cobresia*, but because it was originally spelled as *Kobresia* and never corrected by Willdenow himself, the correct spelling should be *Kobresia*.

The delimitation of the four genera of the Caricoideae, viz. *Carex*, *Kobresia*, *Schoenoxiphium* and *Uncinia*, has been one of the most interesting problems in the caricology. The distinction among them has been ultimately based upon the degree of the connation of the prophylls and the degree of the reduction of flowers in the spikelets. *Carex* and *Uncinia* are thus separable from the other two by the completely connate, bottle-like prophylls which we commonly call utricles. *Uncinia* is further separated from *Carex* in having a conspicuous vestigial rachilla which is exerting the utricle and strongly hooked at the apex. The difference between *Schoenoxiphium* and *Kobresia* is far more delicate than that between *Carex* and *Uncinia*. Kükenthal rather reluctantly distinguished *Schoenoxiphium* from *Kobresia* by the flattened and more elongated rhachillae prominently scabrous on the margins as a rule. In addition to this rachilla character, the two genera must have been separated more or less geographically. The centre of the distribution of *Kobresia* is in the Himalayas and central Asia, while *Schoenoxiphium* is African. The same thing can be said about *Uncinia*, which is a genus of Australia and South America, while *Carex* is more extensive in the Northern Hemisphere.

The discrimination between *Schoenoxiphium* and *Kobresia* became obscured as Kükenthal described *Schoenoxiphium cobresioideum* from Sumatra in Malaysia. The reason why it was considered as a *Schoenoxiphium* is only its flat, elongated rhachilla, however, if this character is so significant, such a species as *Kobresia curvata* of the Himalayas, should also go to *Schoenoxiphium*. Recently, when Kern transferred *Schoenoxiphium cobresioideum* to *Kobresia* (in Act. Bot. Neerl. 7: 786-795. 1958), he gave a very long discussion as to the relationship between *Schoenoxiphium* and *Kobresia*. Conclusively he stated that the difference between

the two is only the phylogenetical meaning. In this respect, I quite agree with him and I can see no reason to keep *Schoenoxiphium* as a separate genus from *Kobresia*, so far as they are considered to be in the same evolutionarily line. The following are the additional transfers of names related to this fusion of the two genera.

**Kobresia Buchananii** (C. B. Clarke), comb. nova=*Schoenoxiphium Buchananii* C. B. Clarke in Dur. & Schinz, Consp. Fl. Afr. 5: 676 (1895).

**Kobresia Dregeana** (Kunth), comb. nova=*Schoenoxiphium Dregeana* Kunth, Enum. Pl. 2: 529 (1837).

**Kobresia Ecklonii** (Nees), comb. nova=*Schoenoxiphium Ecklonii* Nees in Linnaea 10: 200 (1836).

var. **unisexualis** (Kükenth.), comb. nova=*Sch. Ecklonii* Nees var. *unisexualis* Kükenth. Cyper.-Caric. 33 (1909); *Sch. Thunbergii* Nees.

**Kobresia Kunthiana** (Kükenth.), comb. nova=*Schoenoxiphium Kunthianum* Kükenth., Cyper.-Caric. 31 (1909).

**Kobresia lancea** (Thunb.), comb. nova=*Schoenus lanceus* Thunb., Prodr. Fl. Capens. 17 (1794); *Sch. capense* Nees; *Sch. lanceum* (Thb.) Kükenth.

**Kobresia Lehmannii** (Nees), comb. nova=*Uncinia Lehmannii* Nees in Linnaea 10: 206 (1836); *Sch. sparthium* Kükenth. var. *Lehmannii* Kükenth.

var. **Schimperiana** (Böckeler), comb. nova=*Sch. Schimperianum* Böckl. in Linnaea 40: 373 (1876); *Sch. sparthium* Kükenth. var. *Schimperianum* Kükenth.

**Kobresia rufa** (Nees), comb. nova=*Schoenoxiphium rufum* Nees in Linnaea 10: 201 (1836).

var. **pondoensis** (Kükenth.) comb. nova=*Sch. rufum* Nees var. *pondoense* Kükenth., Cyper.-Caric. 31 (1909).

**Kobresia sparthea** (Wahlenb.), comb. nova=*Carex sparthea* Wahlenb. in Vetensk.-Akad. Nya Handl. Stockh. 149 (1803).

The interrelationship between *Uncinia* and *Carex* is almost the same as those between *Schoenoxiphium* and *Kobresia*. Only morphological difference between the two is the remaining rachillae of *Uncinia*, but the presence of the rudimentary rachilla is not a rare occurrence in *Carex*, too. The hooked apices of the rachillae and always unispicate spikes in *Uncinia* suggest that *Uncinia* is not a prototypic condition from which some *Carex*-like plants developed, but is an ultimate state on a small side branch sprung from the so-called proto-*Carex*. This view was supported by Savile and Calder (in Can. Journ. Bot. 31: 168, 1953), who placed *Uncinia* at the tip of a side branch derived from a long-spiked group of the Cariceae. It is therefore reasonable that *Uncinia* is also merged to the genus *Carex*.

Thus I came to the conclusion to regard two genera, *Kobresia* and *Carex* in the tribe Cariceae sensu stricto. Although the relationship between *Carex* and *Kobresia* is ultimately phylogenetical, it is reasonable morphologically to draw a line between bisexual and completely unisexual stages in the reduction series of the spikelets.

**38. Carex** Linn., Gen. Pl. ed. 1, 280 (1737) & Sp. Pl. ed. 1, 972 (1753); Kükenth., Cyper.-Caric. 67 (1909); Ohwi, Cyper. Japon. 1, 232 (1936).

*Schelhammeria* Moench, Meth. Suppl. 119 (1802).—*Uncinia* Persoon, Synops. Pl. 2: 534 (1807), syn. nov.—*Scuria* Rafinesque in Journ. Phys. 89: 106 (1819). *Triodus* Rafinesque, l. c. 106 (1819).—*Triplima* Rafinesque in Amer. Monthly Mag. 195 (1819).—*Vignea* P. Beauvois in Lestib., Ess. Fam. Cypér. 22 (1819).—*Trasus* S. F. Gray, Natur. Arr. Brit. Pl. 2: 53 (1821).—*Phyllostachys* Torrey in Ann. Lyc. N. Y. 3: 404 (1836), non Sieb. & Zucc. (1843) (=Gramineae).—*Maukschia* Heuff. in Flora 27: 527 (1844).—*Psyllophora*, *Leucoglochis*, *Callistachys*, *Generischia* & *Cryptoglochis* Heuff. l. c. 528 (1844).—*Psyllophora* (Ehrh.) Schur. Enum. Pl. Transs. 696 (1866).—*Vignantha* Schur, l. c. 705 (1866).—*Pseudocarex* Miquel in Ann. Mus. Bot. Lugd.-Batav. 2: 146 (1866).—*Neilreichia* Kotule in Spraw, Kom. Fis. Krakow. 17: 136 (1883).—*Caricina* & *Caricinella* St. Lag in Cariot, Etude des Fleures ed. 8, 2: 854 (1889). *Cymophyllus* Mackenzie—*Vignidula* Borner in Abh. Nat. Ver. Bremen 21: 275 (1913).—*Diplocarex* Hayata, Ic. Pl. Formos. 10: 70 f. 47 (1921).

Type: *Carex acuta* Linn. More than 1800 spp. all over the world.

For the discussion see *Kobresia*.

## Part II. A REVISION OF THE SPECIES OF THE CYPERACEAE IN JAPAN AND ITS NEIGHBOURING REGINS

### 1. A brief survey of the history of Japanese cyperology.

Until about the middle of the nineteenth century, no special work had been made as to the cyperology of Japan, except that Thunberg described four species of *Carex* in his Flora Japonica as early as in 1784. They are *C. brunnea*, *C. japonica*, *C. pumila* and *C. tristachya*. Steudel was the earliest cyperologist, who in his Synopsis Plantarum Glumacearum Pt. II (1855) described many new species based on a collection made by Göring, while Boott also published some Japanese Carices for A. Gray's famous work, the Narrative of the expedition of an American squadron to the China seas and Japan (1856). These works were followed by Miquel (1865) and Maximowicz (1886) also in describing new species. Similarly Franchet also continued to add many new taxa through the identification of the Cyperaceae of Japan collected by Savatier and his cooperators, until he summarized them in his Enumeratio plantarum Japonicarum II (1877-79). But all these contributions were too far from completeness, because the collections related were very fragmental.

It is, however, no exaggeration to say that several large collections made by U. Faurie eventually gave the whole picture of the Cyperaceae flora of Japan. Since he got to Japan in 1873 his really energetic botanizing was continued until his death in Formosa in 1914, having left his footmarks not only all over Japan but also as far as in the Hawaiian islands. The majority of his collections, which were sent to Franchet, resulted such an important work, Les Carex de l'Asie orientale (1896-98), by Franchet. On the other hand, the Cyperaceae other than *Carex* of his collections were named by C. B. Clarke and later edited by Lévillé as Cyperaceae (excl. Carices) Japonicae et Coreanae a R. P. Urb. Faurie lectae quas determinavit C. B. Clarke (1904). Soon afterward, Faurie's sedge collections



were again criticized by Kükenthal and were cited in his great monograph of Caricoideae (in Englers Das Pflanzenreich IV-20. 1909). Now these collections are kept in the herbaria of Muséum National d'Histoire Naturelle in Paris and of the Kyoto University in Kyoto, Japan. The herbaria of the British Museum and of the Montreal Botanical Garden in Canada also have some.

It was about at the same time that Matsumura, then Professor at the College of Science, Imperial University of Tokyo, sent Kükenthal and C. B. Clarke almost all the Cyperaceae kept in the herbarium of the University for the identification. Thus the enumeration of the cyperaceous part of his Index plantarum Japonicarum II-1 (1905) was entirely based upon Kükenthal and Clarke's determination. From about that time, the leadership of the Japanese cyperology was gradually taken over by the Japanese taxonomists. Among many meticulous works, Makino's Rhynchospora (in Bot. Mag. Tokyo 17: 179-192. 1903), Hayata's Formosan Cyperaceae, Nakai's *Cyperus* (in Bot. Mag. Tokyo 26: 185-207. 1912), Koidzumi and Honda's new species of *Carex*, and Kitagawa's Manchurian Carices are specially worth mentioning. Akiyama's Conspectus Caricum Japonicarum (1932) was the earliest collective account of *Carex* made by the Japanese botanists, but to say frankly it was still largely depending upon the Kükenthal's monograph.

The most important authority on the Cyperaceae of Japan is Ohwi, who recognized 463 species of 20 genera in his Cyperaceae Japonicae I & II (1960, 1944). In this synopsis are cited most of the Faurie's Cyperaceae, through the reinvestigation of which, Ohwi thoroughly revised the former works made by Franchet, Kükenthal, Akiyama etc. With the detailed precise synonymy, perfect keys, and proper descriptions this successful work is highly evaluated as being a standard synopsis of Cyperaceae on the regional basis. It is also noteworthy that in this synopsis, Ohwi proposed some entirely new ideas as to the system of the subdivisions of the related genera, which have been generally supported in various succeeding workers including Nelmès, S. T. Blake, Kern and myself.

## 2. Enumeration of species.

This enumeration covers 13 genera occurring in Japan and its neighbouring regions, viz. Saghalien, the Kuriles, Korea, the Ryukyus and Formosa. In order to save space and to avoid the repetition of Ohwi's work, I do not give the fully cited synonymy unless a nomenclatorial or conceptional change is necessary. Ohwi's latest opus published in Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, 11 & 18 (1936 & 1934) is hereinafter referred to as 'Cyper. Japon. 1 & 2'. As was already mentioned all the chromosomal data given in this work are entirely depending on Tanaka's publications (1937-48).

Genus 1. *HYPOLYTRUM* L. C. Richard.

Only one species with us:

1. *Hypolytrum formosanum* Ohwi, Cyper. Japon. 2, 168 (1944).

'*H. latifolium* L. C. Rich.': Matsumura, Index Pl. Japon. 2 (1): 153 (1905).  
Formosa (Taipei Hsien etc.). Endemic to Formosa.

Ohwi was, I believe, quite correct to separate *H. formosanum* from *H. latifolium* as specifically distinct. The difference between the two is as follows:

- A. Mature achenes less than 2 mm long, the surface opaque but not wrinkled:  
..... *H. formosanum*  
A. Mature achenes 4—5.5 mm long, the surface smooth and distinctly roughly wrinkled:  
..... *H. latifolium*

## Genus 2. SCIRPUS Linn.

For the treatment of the 34 Far Eastern species of this genus see T. Koyama in Journ. Fac. Sci. Univ. Tokyo Ser. III, 7: 296-363 (1958).

2. *S. supinus* Linn. var. *lateriflorus* T. Koyama.
3. *S. lineolatus* Franch. & Savat.  
For this species add the following locality: Ryukyus: Is. Miyako-jima. T. Tomori s. n. (Herb. Ryukyu Univ.!). New to the flora of the Ryukyus.
4. *S. hondoensis* Ohwi.
5. *S. Wallichii* Nees ex Wight.
6. *S. juncoides* Roxburgh.
7. *S. mucronatus* Linn.
8. *S. triangulatus* Roxburgh.
9. *S. triqueter* Linn.
10. *S. lacustris* Linn. subsp. *glaucus* Hartman.
11. *S. littoralis* Schrader var. *subulatus* T. Koyama.
12. *S. fluitans* Linn. subsp. *pseudo-fluitans* T. Koyama.
13. *S. grossus* Linn. fil.
14. *S. etuberculatus* O. Kuntze subsp. *nipponicus* T. Koyama.
15. *S. planiculmis* F. Schmidt.
16. *S. fluviatilis* A. Gray. Syn. *S. fluviatilis* Gray var. *Yagara* T. Koyama.  
As to this species, Raymond is correct to treat *S. Yagara* from Japan as being quite identical with *S. fluviatilis*, and not a separate variety of it (see Raymond in Nat. Canad. 86: 227. 1959). *S. fluviatilis* was originally described from North America, but now it is widely known also from China, Indo-China, Pacific Islands and New Zealand.
17. *S. Mitsukurianus* Makino.
18. *S. fuirenoides* Maxim.
19. *S. lineatus* Michaux subsp. *Wichurai* T. Koyama.
20. *S. radicans* Schkuhr.
21. *S. sylvaticus* Linn. var. *Maximowiczii* Regel.
22. *S. atrovirens* Willd. var. *georgianus* Fernald.
23. *Scirpus ternatanus* Reinw. ex Miquel.

Correct var. *kiushuensis* as follows:

var. **sutchuensis** Tang in Bull. Fan Mem. Inst. Biol. 3: 361 (1932).

*S. kiushuensis* Ohwi in Fedde, Repert. 36: 44 (1934), syn. nov.

*S. ternatanus* Reinw. ex Miq. var. *kiushuensis* (Ohwi) T. Koyama, l. c. 349, f. 17 (1958).

Kyushu—China (Szechuan!).

Having examined the isotype of var. *sutchuensis* Tang (F. T. Wang 20920 in A!), I found that *S. kiushuensis* is identical with the variety. This identity confirms my observation (T. Koyama l. c.) that the variety is merely an inland form of *S. ternatanus* and not a separate species.

24. *S. Maximowiczii* C. B. Clarke.
25. *S. subcapitatus* Thwaites var. *morrisonensis* Ohwi.
26. *S. hudsonianus* Fernald.
27. *S. cespitosus* Linn. var. *callosus* Bigelow.
28. *S. Ardea* T. Koyama (= *Eriophorum gracile* Koch).
29. *S. angustifolius* T. Koyama (= *Eriophorum angustifolium* Honck.).
30. *S. Fauriei* T. Koyama (= *Eriophorum vaginatum* Linn. subsp. *Fauriei* (E. G. Camus) T. Koyama).
31. *S. brachyantherus* T. Koyama (= *Eriophorum brachyantherum* Trautv.).
32. *S. russeolum* T. Koyama (= *Eriophorum russeolum* Fries).
33. *S. leucocephalus* T. Koyama (= *Eriophorum Scheuchzeri* Hoppe).
34. *S. ciliaris* Linn. (= *Fuirena ciliaris* Roxburgh).
35. *S. Fuirena* T. Koyama (= *Fuirena umbellata* Rottböll).

#### PROBABLE NATURAL HYBRIDS

- (1) *S. arunensis* Druce: *S. Tabernaemontani* × *S. triqueter*.
- (2) *S. igaensis* T. Koyama: *S. juncoides* var. *Hotarui* × *S. lineolatus*.
- (3) *S. Fujimakii* M. Kikuchi & T. Koyama: *S. fuirenoides* × *S. lineatus* ssp. *Wichurai*.
- (4) *S. oguraensis* T. Koyama: *S. triangulatus* × *S. Wallichii*.
- (5) *S. trapezoideus* Koidz.: *S. juncoides* var. *Ohwianus* × *S. triangulatus*.
- (6) *S. uzenensis* Ohwi ex T. Koyama: *S. lineolatus* × *S. triangulatus*.

#### Genus 3. ELEOCHARIS R. BROWN.

This morphologically uniform genus was divided by C. B. Clarke into two subgenera, *Limnochloa* and *Eu-eleocharis*, chiefly by the thickness of culms and the shape of spikelets. These groups are natural and well circumscribed and I agree with Clarke in broad outline, except for the group of *E. pauciflora*. Because of its styles confluent to achene, it was placed by Clarke in the genus *Scirpus*, however, the group of *E. pauciflora* is better treated as being a special small group of *Eleocharis* as generally done, for the scarious margined, very thin scales, and less silicate epidermis of culms show a more close affinity with *Eleocharis* than with *Scirpus* sect. *Isolepis*. In the classification accepted here, the genus is therefore divided into three groups as shown below. I prefer to represent them by sections. The division of series of each section were chiefly adapted from Svenson (1919). He classified the genus into 11 series and the system was soon afterward accepted by Blake, however, two series of them, viz. *Mutatae* and *Pauciflorae*, seem to be far more distinct than the others, and are worthy of maintaining as sections in my opinion.

Section 1. **LIMNOCHLOA** (Nees) Torrey in Ann. Lyc. Nat. Hist. N. Y. 3: 296 (1836).  
Gen. *Limnochloa* Nees in Wight, Contrib. Bot. Ind. 71 (1834) & in Linnaea 9: 294 (1934),

non Lestib. (1819).—Subgen. *Limnochloa* (Nees) C. B. Clarke in Kew Bull. Add. Ser. 8, 105 (1908).—Ser. *Mutatae* Svenson in Rhodora **31**: 127 (1929).

Type: *Limnochloa mutata* (Linn.) Nees (= *E. mutata* Röm. & Schult.).

Section 2. **Pauciflorae** (Svenson) T. Koyama, stat. nov.

*Eleocharis* ser. *Pauciflorae* Svenson in Rhodora **31**: 127 (1929)—'Gen. *Scirpus*': C. B. Clarke in Kew Bull. Add. Ser. 8, 111 (1909) pro pte.

Type: *E. pauciflora* (Lightf.) Link.

Section 3. **Eleocharis**.

Gen. *Scirpidium* & *Eleogenus* Nees in Linnæa **9**: 293 & 294 (1834)—Sect. *Scirpidium* & *Eleogenus* (Nees) Benth. & Hook. f., Gen. Pl. **3**: 1047 (1883)—Subgen. *Eu-eleocharis* C. B. Clarke in Kew Bull. Add. Ser. 8, 105 (1908) incl. sectiones subgeneris.

Type: *E. palustris* (Linn.) Römer & Schultes.

Ser. a. **Aciculares** Svenson in Rhodora **31**: 128 (1929).—Gen. *Scirpidium* Nees, l. c. Type: *E. acicularis* Röm. & Schult.

Ser. b. **Multicaules** Svenson, l. c. **41**: 4 & 95 (1939)—Ser. *Tuberculosae* Svens. l. c. **31**: 129 (1929) p. p. Type: *E. multicaulis* Sm.

Ser. c. **Chaetriae** (C. B. Clarke) T. Koyama, stat. nov.—Sect. *Chaetariae* C. B. Clarke in Kew Bull. Add. Ser. 8, 106 (1908). Type: *E. Chaetaria* Römer & Schult.

Ser. d. **Ovatae** Svenson, l. c. **31**: 128 (1929)—Sect. *Capitatae* C. B. Clarke in Kew Bull. Add. Ser. 8, 105 (1908)—Ser. *Maculosae* Svens., l. c. 128 (1929). Type: *E. ovata* (Roth) Römer & Schult.

Ser. e. **Eleocharis**.—Ser. *Palustriformes* Svenson, l. c. **31**: 128 (1929) incl. subseries. Type: *E. palustris* Römer & Schult.

1. Spikelets ovoid or ellipsoid, distinctly wider than slender, wiry or capillary culms; floral scales with 1-nerved keel.
2. Stylebase confluent to apex of achene, thus not jointed at base. (Sect. **Pauciflorae**)
  3. Medium-sized plants more than 20 cm tall; achenes about 3 mm long. .... 36. *E. margaritacea*
  3. Small, capillary plants less than 5 cm tall; achenes 1 mm long. .... 37. *E. parvula*
2. Stylebase pyramidally thickened, distinctly jointed at base. (Sect. **Eleocharis**)
  4. Stigmas 3.
    5. Culms capillary; achenes trabeculate under magnification; spikelets more or less loose-flowered with more or less erect scales; never proliferous.
      6. Achenes distinctly longitudinally ridged and transversely septate, so that external cells being transversely rectangular. (Ser. *Aciculares*) ..... 38. *E. acicularis*
      6. Achenes faintly scrobiculate, external cells rather longitudinally oblong. (Ser. *Chaetariae*) ..... 39. *E. Chaetaria*
    5. Culms usually stouter (but see *E. pellucida*); achenes smooth or inconspicuously aveolate under magnification; spikelets often proliferous. (Ser. *Multicaules*).
      7. Culms very slender to capillary, less than 0.5 mm wide; less than 15 cm tall; spikelets less than 2.5 mm wide ..... 40. *E. congesta*
      7. Culms 0.5–2.5 mm thick, usually more than 20 cm tall; spikelets more than 3 mm wide.
        8. Spikelets broadly ovoid, 0.6–0.8 mm long. .... 41. *E. attenuata*
        8. Spikelets oblong-ellipsoid, 1–2 cm long.
        9. Perianth bristles 1.5 times longer than body of achene, relatively sparsely



- retorsely plumoso-scabrous; stylebase half as long as body of achene.  
 ..... 42. *E. teraquetra*
9. Perianth bristles more than 2 times longer than body of achene, densely plumose; stylebase large, as long as body of achene. .... 43. *E. Wichurai*
4. Stigmas 2.
10. Spikelets ovoid or globular-ovoid; stylebase less turgid; plants tufted without elongate stolon. (Ser. *Ovatae*).
11. Achenes brownish when mature; stylebase compressed, lamelliform. ... 44. *E. ovata*
11. Achenes blackish when mature; stylebase depressed.
12. Achenes 1 mm long; orifice of sheaths firm. .... 45. *E. geniculata*
12. Achenes 0.5—0.6 mm long; orifice of sheaths hyaline. .... 46. *E. atropurpurea*.
10. Spikelets cylindrical or oblong-ellipsoid; stylebase turgid, very spongy; plants usually stoloniferous. (Ser. *Eleocharis*).
13. Basal empty scales of spikelets 2 to 3.
14. Floral scales acute at apex; stylebase conical to subulate-conical, at least longer than wide. .... 47. *E. palustris*.
14. Floral scales rounded at apex; stylebase broadly deltoid to somewhat semi-circular, as broad as or broader than long.
15. Culms soft, strongly compressed when dry, septate-nodulose; orifice of sheaths thin; spikelets ellipsoid, obtuse-tipped; achenes olivaceous or tawny.  
 ..... 48. *E. mamillata*
15. Culms hard, distinctly several-ribbed, smooth; orifice of sheaths firm; spikelets cylindrical, suddenly acute at apex; achenes fuscous. .... 49. *E. valleculosa*
13. Basal empty scale of spikelet only 1. .... 50. *E. kamtschatica*
1. Spikelets cylindrical, as broad as thick soft culms; floral scales many-nerved without distinct midvein. (Sect. **Limnochloa**).
16. Culms empty, transversely septate.
17. Achenes distinctly annulate at apex; stylebase attached to annule, 1/3 as wide as body of achene at very base; floral scales 3 times longer than width, rounded-acute at apex, light tawny. .... 51. *E. Kurogurwai*
17. Achenes never annulate at apex; stylebase directly attached to body of achene, 1/2 as wide as body of achene at very base; floral scales 1.5 times longer than width, truncate-rounded at apex, white. .... 52. *E. dulcis*
16. Culms solid, non-septate.
18. Culms terete; stylebase not constricted at base. .... 53. *E. ochrostachys*
18. Culms triquetrous; stylebase constricted at base. .... 54. *E. fistulosa*

**36. *Eleocharis margaritacea*** (Hultén) Miyabe & Kudo, Fl. Hokkaido & Saghal. 2: 210 (1931); Zinserling in Komarov, Fl. URSS. 3: 89 (1935); Ohwi, Cyper. Japon. 2, 34 (1944) & Fl. Japan 223 (1953).

*Scirpus margaritaceus* Hultén, Fl. Kamtsch. 1: 167, f. 12 (1927).

*E. margaritacea* (Hultén) Svenson in Rhodora 35: 386, t. 320, f. 7 (1934).

Hokkaido: Teshio, Sarobetsu moor. T. Koyama 11038 (TNS!); Kitami, Hamatombetsu. J. Ohiwi 4533 (KYO!); Ishikari, Horomui. H. Takeda s. n. (TNS!)—Kuriles: Is Kunashiri, Furukamappu. J. Ohwi 892 (KYO!)—Honshu: Rikuchu, Harukoyachi. A. Fujimaki 8624 (auct. herb.!)—Kamtschatka. Swamp. Japanese name: *Shiromino-harii*.

A very distinct species of the northern Pacific elements. This is unquestionably

related to *E. pauciflora* of wider distribution in the pale scarious scales chestnut-coloured on both sides. The large whitish nuts about 3 mm long with a long attenuate stipe are unique in the series Pauciflorae. More or less discoid-annulate apices of achenes clearly separate this from *E. pauciflora*, being the character, at the same time, that proves the series Pauciflorae to be a special group of the genus *Eleocharis* and not a part of *Scirpus*. The combination was made by both Miyabe and Svenson quite independently.

**37. *Eleocharis parvula*** (Römer & Schult.) Link ex Bluff, Nees & Schaubert in Bluff & Fingerh., Compend. Fl. Germ. ed. 2, **1** (1): 93 (1836); Palla in Engl., Bot. Jahrb. **10**: 299 (1889) & in Koch, Synops. ed. 3, **3**: 2542 (1907); Hegi, Illustr. Fl. Mitteleur. **2**: 41, f. 198 (1909); Svenson in Rhodora **31**: 168, f. 18 (1929) & in North Amer. Fl. **18** (9): 513 (1957); Ohwi, Cyper. Japon. 2, 34, (1944) & Fl. Japan 223 (1953); Fernald, Gray's Man. Bot. ed. 8, 252, f. 376 (1950); Kern in Reinwardtia **4**: 94 (1956).

*Scirpus pusillus* Vahl, Enum. Pl. **2**: 246 (1805); Pursh, Fl. Amer. Septentr. **1**: 54 (1816); Torrey, Fl. N. Midd. Stat. **1**: 46 (1824), non R. Br. (1810).—*Scirpus nanus* Spreng., Pugill. **1**: 4 (1813); Robinson & Fern. in A. Gray, Man. Bot. ed. 7, 189 (1908), non Poiret (1804).—*Scirpus pollicaris* Delile, Fl. Aeg. Illustr. **19**: 50 (1813) nomen & t. 63, f. 10 (1882).—*Scirpus parvulus* Römer & Schultes, Syst. Veg. **2**: 124 (1817); Aschers. & Graebn., Synops. Mitteleur. Fl. **2** (2): 297 (1904); Blomgr. in Holmg., Skand. Fl. 310 (1926).—*Scirpus humilis* Wallr., Sched. Crit. 27 (1822).—*Eleogiton parvula* (Römer & Schult.) Link, Hort. Berol. Descript. **1**: 285 (1827).—*Limnochloa parvula* (Römer & Schult.) Reichenb. in Mossler, Handb. ed. 2, **3**: 1808 (1829).—*Baeothryon nanum* (Spreng.) & *pusillum* (Vahl) A. Dietr., Sp. Pl. **2**: 92 (1833).—*E. pygmaea* Torrey in Ann. Lyc. N. Y. **3**: 313 (1836).—*Scirpus translucens* Legall in Lloyd, Fl. Loire Inf. 275 (1844).—*Cyperus parvulus* (Römer & Schult.) Missbach & Kraus in Strum, Fl. Deutsch, ed. 2, **2**: 26, t. 7 (1900), non Steud. (1855).

Kyushu: Chikuzen, Imazumura. S. Hatsushima 8 (KYO!); Is. Tsushima, Kamoda. K. Nakajima 8495 (KYO!)—Europe, Africa, N. & S. America. Marshy places along coast, rare. Japanese name: *Chaboi*.

This was first described in Germany. Though very widely distributed, this is known only in two localities cited above in Japan. The slender stolons usually bear a small tuber at the end.

**38. *Eleocharis acicularis*** (Linn.) Römer & Schultes, Syst. Veg. **2**: 154 (1817); Britton in Journ. N. Y. Micr. Soc. **5**: 104 (1889); Hegi, Illustr. Fl. Mitteleur. **2**: 41 (1909); Svenson in Rhodora **31**: 184 (1929) & in North Amer. Fl. **18** (9): 516 (1957); Ohwi, Cyper. Japon. 2, 35 (1944) & Fl. Japan 223 (1953).

*Scirpus acicularis* Linn., Sp., Pl. ed. 1, 48 (1753); Aschers. & Graebn., Synops. Mitteleur. Fl. **2** (2): 303 (1904); Blomgr. in Holmg., Skand. Fl. **2**: 309 (1926).—*Mariscus acicularis* (Linn.) Moench, Meth. 350 (1794).—*Cyperus acicularis* (Linn.) With., Brit. Fl. ed. 3, **2**: 78 (1796); Missbach & Kraus in Strum, Fl. Deutsch. ed. 2, **2**: 23, t. 6, f. 1 (1900).—*Scirpus trichodes* Muhl., Descr. Gram. 30 (1817).—*E. costata* Presl, F. Cech. 11 (1819).—*Isolepis acicularis* (Linn.) Schultes, Fl. Berol. **1**: 36 (1823).—*Scirpus Chaeta* Schultes in Römer & Schult., Syst. Veg. Mant. **2**: 72 (1824).—*Clavula acicularis* & *comosa* Dumortier, Fl. Belg. 143 (1827).—*Scirpidium aciculare* (Linn.) Nees in Linnaea **9**: 293 (1834), nomen.—*Chaetocyperus acicularis* (Linn.) Nees

in Martius, Fl. Brasil. **2** (1): 95 (1842), p. p.; Steudel, Synops. Pl. Glum. **2**: 74 (1855).—*E. comosa* K. Richt, Pl. Eur. **1**: 143 (1890).—*E. acicularis* Röm. & Schult. varr. *typica* & *occidentalis* Svenson in Rhodora **31**: 184 & 190 (1929).

Chromosomes:  $2n=30-58$ ,  $50-70$ .

Widespread in the boreal parts of N. Hemisphere. Kuriles, Korea (n. part.!). Wet places. forma **longiseta** (Svenson) T. Koyama, stat. nov.

*E. acicularis* Römer & Schult. var. *longiseta* Svenson in Rhodora **31**: 189 (1929); Ohwi, Cyper. Japon. **2**, 36 (1944) & Fl. Japan **224** (1953).—*Scirpus yokoscensis* Fr. & Sav., Enum. Pl. Japon. **2**, 109 (1877) & 543 (1879), cf. Svens. & Ohwi.—*E. acicularis* Römer & Schult. var. *japonica* Baker in Diels, Bot. Jahrb. **29**: 228 (1900), nomen.—*E. Svensonii* Zinserling in Komarov, Fl. URSS. **3**: 71, t. 6, f. 5 & 580 (1935).

Chromosomes:  $2n=20$ .

Hokkaido (Oshima), Honshu, Shikoku, Kyushu, Korea, Ryukyus, Formosa—China. (Yunnan), Indo-China. Common in wet places, often in rice paddy. Japanese name: *Matsuba-i*.

For the Indo-Chinese data see T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 36 (1957). The form *longiseta* is distinguished from typical *E. acicularis* by the perianth bristles conspicuously exceeding the achene. In typical form, perianth bristles are quite or nearly absent, and if present weaker. It is of interest that the chromosomes are so different in number between typical form and forma *longiseta*. For this reason, I compared many Japanese and Ryukyuan specimens with typical form from various places of the total area. Only constant difference between them is, after all, the state of bristles stated above, though European and American plants sometimes have longer spikelets up to 7 mm long (up to 4 mm in Japanese ones) and more distinctly sanguineous scales. In Korea and China, both forms have been seen.

**39. Eleocharis Chaetaria** Römer & Schultes, Syst. Veg. **2**: 154 (1917) & Syst. Veg. Mant. **2**: 90 (1924); Kunth, Enum. Pl. **2**: 140 (1837); Bockeler in Linnaea **36**: 428 (1870); C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 629 (1893); E. G. Camus in Lecomte, Fl. Génér. Ind-China **7**: 87, f. 12, 7-8 (1912); Svenson in Rhodora **39**: 250, t. 461, f. 10 (1937) & **41**: 113 (1939); S. T. Blake in Proc. Roy. Soc. Queensl. **58**: 42 (1947); Ohwi in Bull. National Sci. Mus. **34**, 3(1954); T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 37 (1957); Hatusima & Amano, Fl. Okinawa **131** (1958).

*Cyperus setaceus* Retzius, Observ. **5**, 10 (1789); Roxb., Fl. Ind., ed. 1, **1**: 185 (1820).—*Scirpus pygmaeus* Lamarck, Illustr. **1**: 139 (1791).—*Chaetocyperus setaceus* (Retz.) Nees (in Linnaea **9**: 289 (1934), nomen) ex Miquel, Fl. Ind. Batav. **3**: 298 (1855); Thwaites, Enum. Pl. Zeyl. **351** (1864).—*Chaetocyperus Limnocharis* Nees ex Wight, Contrib. Bot. Ind. **96** (1834).

Ryukyus: Is. Ishigaki, Mt. Omotodake. E. H. Walker & al. 7269 (TNS!), S. Tawada 90 (TNS!), S. Hatusima (KAG!).—Indo-China, India, Ceylon, Malaysia.

The occurrence of this species in the Ryukyus was recently reported by Ohwi (l. c.). In the Ryukyus, this plant is growing in small wet area near the summit of Mt. Omotodake on Is. Ishigaki. On the one hand, according to Hayata's label, this was collected in Indo-China 'au bord de la mer' (cf. T. Koyama l. c.).

**40. *Eleocharis congesta*** D. Don, Prodr. Fl. Nepal 41 (1825); Kunth, Enum. Pl. 2: 152 (1837); C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 630 (1893) & ex Léveillé in Bull. Acad. Intern. Géogr. Bot. 14: 203 (1904); Matsumura, Index Pl. Japon. 2 (1): 145 (1905); E. G. Camus in Lecomte, Fl. Génér. Indo-Chine 7: 88 (1912); C. E. C. Fischer, Fl. Presideney Madras 1648 (1931); Svenson in Rhodora 41: 102, f. 546, f. 2 (1939); T. Koyama in Contrib. Inst. Bot. Univ. Montréal 70, 38 (1957).

*E. subprolifera* Steudel, Synops. Pl. Glum. 2: 80 (1855); Miquel, Fl. Ind. Batav. 3: 300 (1855); Koorders, Exkursionsfl. Java 1: 197 (1911) & 4: 103, f. 246 (1922).—*E. purpurascens* Bockeler in Linnaea 36: 455 (1870).—*E. pellucida* Presl forma *attenuata* Ohwi, Cyper. Japon. 2, 38 (1944), excl. basionym.

forma ***dolichochoeta*** T. Koyama, forma nova,\* setis hypogynis usque subduplo longioribus quam nucibus.

Honshu (Central part and westwards, more frequent on Pacific side), Kyushu.—Indo-China, India (Himalayas). Marshy places in lowlands, often in rice paddy. Japanese name: *Oh-harii*.

Plants from Japan constantly have longer perianth bristles than in Himalayan plants.

var. ***japonica*** (Miquel) T. Koyama, comb. nova.

*E. pellucida* Presl, Reliq. Haenk. 1: 196 (1828); Svenson in Rhodora 41: 101 (1939); Ohwi, Cyper. Japon. 2, 39 (1944), excl. f. *attenuata* Ohwi, & Fl. Japan 224 (1953); T. Koyama in Contrib. Inst. Bot. Univ. Montréal 70, 37 (1957).—*E. afflata* Steudel in Zollinger, Verz. Ind. Archip. 62 (1854) & Synops. Pl. Glum. 2: 76 (1855); Miquel, Fl. Ind. Batav. 3: 299 (1855).—*Scirpus afflatus* Benthham, Fl. Hongk. 394 (1861).—*E. japonica* Miquel in Ann. Mus. Bot. Lugd.-Batav. 2: 142 (1865).—*E. Thompsoni* Bockler. in Linnaea 36: 451 (1876).—*Scirpus japonicus* (Miquel) Franch. & Savat., Enum. Pl. Japon. 2: 109 (1877), non Fern. (1905).—*E. chorocarpa* Bockler. in Flora 59: 34 (1878).—*E. Kunthii* Bockler., Cyper. Nov. 1: 14 (1888). *E. Gambleana* Bockler. in Allg. Bot. Zeitschr. 1896: 54 (1896).—*E. afflata* Steud. var. *japonica* (Miq.) C. B. Clarke ex Léveillé in Bull. Acad. Intern. Géogr. Bot. 14: 203 (1904), p. p.—*E. Shimadai* Hayata, Icon. Pl. Formosa 6: 107, f. 24 (1916).—*E. pellucida* Presl forma *japonica* (Miquel) Ohwi, Cyper. Japon. 2, 40 (1944).

Chromosomes:  $2n=20$ .

Hokkaido (Oshima peninsula), Honshu, Shikoku, Kyushu, Korea, Ryukyus, Formosa—India, Indo-China, Malaysia. Common in wet places, very often in rice paddy. Japanese name: *Hari-i*.

A Japanese spike-rush, roughly called as *E. japonica* or *E. pellucida*, contains at least two different races fairly distinct from one another. One is characterized by very capillary culms and small spikelets up to 7 mm long and 1.8 mm wide. In this race, floral scales are small, less than 1.2 mm long, and achenes are about 0.8 to 1 mm long. Another is characterized by thick culms up to 18 cm tall, 1 mm wide, and large spikelets up to 12 mm long and 4 mm wide. Floral scales are about 2 mm long, with slightly larger achenes 1.2 to 1.5 mm long. The former race exactly agrees with Malaysian plants commonly called *E. afflata*. This is unquestionably identical with *E. pellucida* of Luzon as explained by many specialists concerned. The latter robust race occurs more scarcely than the former in Japan.

\* Type: Japonia, Kii, Shinjo-mura. K. Mihashi 166 (TI!).



Having examined several specimens from Indo-China and the Himalayas, and judging from a drawing given by Svenson (l. c.), I am sure that this falls within *E. congesta* of India. Indo-Chinese plants sometimes shows perennial habit with many withered culms together with new ones, however, the duration of rootstock seems to be very unstable in some species of *Fimbristylis*, *Scirpus*, and *Eleocharis*, especially in tropics and subtropics. Ohwi (l. c.), perhaps hardly realizing the difference, distinguished the latter as a form of the former. But, the discontinuity in the size of floral scales is clear so far as I have seen specimens, besides the culms of the latter are invariably septate-nodulose, while those of *E. pellucida* are hard and ridged only. Though they are not to be specially distinct, I believe that they can be separated as a variety enough. I have not seen the type of Steudel's *E. subprolifera*, but according to its description, and a drawing given by Koorders, it will be typical *E. congesta*.

var. **subvivipara** (Böckl.) T. Koyama, comb. nova.

*E. subvivipara* Böckeler in Linnaea **36**: 424 (1879); C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 629 (1839) & Ill. Cyper. t. 37, f. 13-16 (1909).—*E. nipponica* Makino in Bot. Mag. Tokyo **18**: 110 (1904).—*E. Chaetaria* Römer & Schult. var. *subvivipara* (Böckl.) Fischer, Fl. Presidency Madras 1648 (1931).—*E. pellucida* Presl var. *nipponica* (Makino) Ohwi, Cyper. Japon. **2**: 41 (1944) & Fl. Japan 224 (1953).

Honshu, Kyushu, Ryukyus—India. Japanese name: *Yari-harii*.

The larger, subulate-conical stylebase  $2/3$  to  $3/4$  as broad as the body of achene ( $1/3$  to  $1/2$  in var. *japonica*), and linear-lanceolate spikelets characterize this variety. These characters are well shown in Clarke's Illustration (l. c.), and Japanese *E. nipponica* can be identified with *E. subvivipara* of India. As for the plants from Japan, it is of interest that this variety shows very high sterility and that the proliferation is more active than in other varieties. From these evidences, Ohwi supposed that it would be a natural hybrid.

var. **thermalis** (Hultén) T. Koyama, comb. nova.

'*E. afflata* Steud. var. *japonica* C. B. Clarke' ex Lévl. in Bull. Acad. Inter. Géogr. Bot. **14**: 203 (1904), p. p. excl. basionym.—*Scirpus japonicus* Franch. & Savat. var. *thermalis* Hultén, Fl. Kamtach. **1**: 165 (1927).—*E. Maximowiczii* Zinserling in Komarov, Fl. URSS. **3**: 88, t. 7, f. 1, & 588 (1935), syn. nov.—*E. japonica* Miq. var. *thermalis* (Hultén) Hara in Bot. Mag. Tokyo **52**: 395 (1938).—*E. pellucida* Presl var. *thermalis* (Hultén) Hara in Journ. Jap. Bot. **16**: 263 (1940); Ohwi, Cyper. Japon. **2**, 40 (1944) & Fl. Japan 224 (1933).—*E. pellucida* Presl var. *Maximowiczii* (Zinserl.) Ohwi, Cyper. Japon. **2**, 41 (1944).

Hokkaido, Honshu—Manchuria, Amurland, Ussuri, Kamtschatka. Japanese name: *Yezo-harii*.

This appears to be more distinct than any other variety of *E. congesta*, by more or less depressed-conical stylebase at least wider than long, and perianth bristles slightly shorter than achenes, which are deep olive-green at full maturity. The spikelets are seldom proliferous. Zinserling's original description of *E. Maximowiczii* runs as follows: "achenium elongato-obovoideum rotundato-triquetrum; stylopodium minutum breviter (usque ad abbrevissime) conicum latitudine longitudinem superante; setae hypogynae 6, achenio breviores dentibus parvis retrorsis."

There I can see no difference between var. *thermalis* and *E. Maximowiczii*, though not seeing the type of the latter.

**41. Eleocharis attenuata** (Franch. & Savat.) Palla in Mond. des Pl. **12**: 40 (1910); Hara in Journ. Jap. Bot. **19**: 153 (1942) **30**: 333 (1943), & **32**: 140 (1957).

*Scirpus attenuatus* Franch. & Savat., Enum. Pl. Japon. 2, 110(1877) & 543 (1879).—*E. major* Hara in Journ. Jap. Bot. **11**: 820, f. 24 (1935); Okuyama in Journ. Jap. Bot. **12**: 190 (1936).—*E. leviseta* Nakai var. *major* (Hara) Hara in Journ. Jap. Bot. **14**: 521 (1938); Ohwi, Cyper. Japon. 2, 42 (1944) & Fl. Japan 224 (1953).—*E. pellucida* Presl forma *attenuata* (Franch. & Savat.) Ohwi, Cyper. Japon 2, 40 (1944), quoad basionym. tantum.

Chromosomes: 20=20.

Honshu, Shikoku, Kyushu, Ryukyus. Wet, open, grassy fields. Japanese name: *Seitaka-harii*.

In typical form, perianth bristles are retrorsely scabrous, thus a form with quite smooth bristles is separated as:

forma **leviseta** (Nakai) Hara in Journ. Jap. Bot. **32**: 140 (1957).

*E. leviseta* Nakai (ex Mori, Enum. Pl. Corean. 71 (1922) nomen) in Fedde, Repert, **13**: 246 (1914); Svenson in Rhodora **41**: 100, t. 546, f. 4 (1939); Ohwi, Cyper. Japon. 2, 4 (1944) & Fl. Japan 224 (1953).—*E. attenuata* Palla var. *leviseta* (Nakai) Hara in Journ. Jap. Bot. **19**: 153 (1943).

Honshu (Shinano, Kai), Korea (s. part, Is. Quelpaert).

As Svenson (l. c.) thought that this is closely related to *E. congesta* var. *thermalis*, *E. attenuata* is outwardly very similar to *E. congesta*. Concerning the thickness of culms, these two are not so different, but they can easily be distinguished by scale and achene characters. In *E. attenuata*, floral scales are thinner, and always very slenderly keeled with one midvein, and the stylebase is broadly margined perfectly covering the apex of the body of achene, while in *E. congesta*, floral scales are always broadly keeled with a conspicuous green belt, and the stylebase is narrower as stated under the preceeding species.

**42.\* Eleocharis tetraquetra** Nees ex Wight, Contrib. Bot. Ind. 113 (1834); F. v. Mueller, Fragm. Phytogr. Austral. **8**: 239 (1874); Bailey, Queensl. Fl. **6**: 1775 (1902); Koorders, Exkursionsfl. Java **1**: 197 (1911) & **3**: 103, f. 247 (1922); Domin in Bibl. Bot. **20**: Heft 85, 448 (1915); Merrill, Enum. Philip. Flow. Pl. **1**: 121 (1922); C. E. C. Fischer, Fl. Presidency Madras 1647 (1931); Svenson in Rhodora **41**: 99-100 (1939), pro pte.; S. T. Blake in Proc. Roy. Soc. Queensl. **50**: 111, t. 9, f. 12-15 (1939); Ohwi, Cyper. Japon. 2, 36 (1944) & Fl. Japan 224 (1953); T. Koyama in Contrib. Inst. Bot. Univ. Montréal 70, 38 (1957).

*Limnochloa tetraquetra* Nees ex Wight, Contrib. Bot. Ind. 113 (1834), pro syn.—*E. erythrochlamys* Miquel, Fl. Ind. Batav. **3**: 300 (1855).—*Scirpus tetraqueter* (Nees) Thwaites, Enum. Pl. Zeyl. 454 (1864).

Honshu: Ohmi, Ohtsu. Ch. Hashimoto 11319 (auct. herb. !); Bitchu, Tarui. Z. Yoshino 481 (TI !); Iwami, Yunotsu-machi. S. Takagi (KYO !): Nagoto, Susamura. J. Nikai (TNS !)—Kyushu, Ryukyus, Formosa—Indo-China, China, India Malaysia, Australia. Wet places along margin of pond or river. Relatively scarce. Japanese name: *Mashikaku-i*.

forma **Tsurumachii** (Ohwi) T. Koyama, stat. nov.

\* var. *annamica* T. Koyama. (Indo-China).

*E. Tsurumachii* Ohwi in Act. Phytotax. Geobot. 2, 29 (1933).—*E. tetraquetra* Nees var. *Tsurumachii* (Ohwi) Ohwi in Act. Phytotax. Geobot. 6: 151 (1937); Cyper. Japon. 2, 37 (1944) & Fl. Japan 224 (1953).

Honshu: Hitachi, Tamatsukuri. H. Tsurumachi. (Type of *E. Tsurumachii* in KYO!, isotype in TNS!).

A form distinguished by the broader hyaline margins of floral scales only.

**43. *Eleocharis Wichurai*** Böckeler in Linnaea 36: 448 (1870); Ohwi, Cyper. Japon. 2: 37 (1944) & Fl. Japan 224 (1953).

*Scirpus hakonensis* Franch. & Savat., Enum. Pl. Japon. 2: 110 (1876), nom. seminud. —*Scirpus Onoei* Franch. & Savat., l. c. 2: 544 (1879).—*Scirpus Wichurai* (Böckl.) Franch. & Savat., l. c. 544 (1879), non Böckl. (1870).—*Scirpus petasatus* Maxim. in Bull. Soc. Imp. Nat. Moscou 54 (1): 64 (1879).—*Scirpus yokuhamensis* O. Kuntze, Rev. Gen. Pl. 2: 758 (1891). —‘*E. tetraquetra* Nees’: Komarov, Fl. Mashur. 1: 351 (1901); C. B. Clarke in Journ. Linn. Soc. 36: 229 (1903), p. p.; Matumura, Index Pl. Japon. 2 (1): 146 (1905), p. p.; Nakai, Fl. Korean. 2: 297 (1911); Miyabe & Kudo, Fl. Hokkaido & Saghal. 2: 210 (1931); Svenson in Rhodora 41: 99-100 (1939), p. p.—*E. tetraquetra* Nees var. *Wichurai* (Böckl.) Makino in Bot. Mag. Tokyo 19: 16 (1905).—*E. petasata* (Maxim.) Zinserling in Komarov, Fl. URSS. 3: 90, t. 7, f. 16, & 589 (1935).—*E. Wichurai* Böckl. forma *petasata* (Maxim.) Hara in Bot. Mag. Tokyo 52: 396 (1938).

Chromosomes: 2n=20.

Kuriles (Kunashiri, Shikotan), Hokkaido, Honshu, Shikoku, Kyushu, Korea.—N. China, Manchuria, Amurland, Kamtschatka. Japanese name: *Shikakui*.

A form with softer, terete culms is:

forma **teres** (Hara) Ohwi, Cyper. Japon. 2, 38 (1944), in descr.

*E. liukiensis* Makino in Bot. Mag. 18: 111 (1904), e typo!—*E. Wichurai* Böckl. var. *teres* Hara in Bot. Mag. Tokyo 52: 398 (1938) in adnota.—*E. Wichurai* Böckl. var. *liukiensis* (Makino) Ohwi, Cyper. Japon. 2, 39 (1944).

Honshu, Kyushu, Ryukyus: Is. Okinawa. Y. Tashiro 11 (Type of *E. liukiensis* in TI!)

*E. Wichurai*, having plumose perianth bristles, has been much confused with *E. tetraquetra*, bearing retrorsely scabrous bristles, until Ohwi cleared up (in Act. Phytotax. Geobot. 2: 271, 1933). Besides the characters of achenes mentioned in the key to species, *E. Wichurai* can be separated very clearly from *E. tetraquetra* by less sanguineous-tinged, broader scales more obtuse at apex, fewer-flowered spikelets always rounded to obtuse at apex (suddenly acute in *E. tetraquetra*), and less reddish basal sheaths. The number of angles of culms is indefinite in both species. So, I can not regard *E. petasata* as a taxon, even if a forma. On the other hand, however, the terete culms of forma *teres* are always soft, and obscurely septate-nodulose. The Tashiro's specimen, on which *E. liukiensis* was based, is the only record of this northern species in the Ryukyus.

**44. *Eleocharis ovata*** (Roth) Römer & Schultes, Syst. Veg. 2: 152 (1817); Fernald in Proc. Amer. Acad. 34: 494, ff. 8-10 (1889) & Gray's Man. Bot. ed. 8, 255, f. 390 (1950); Hegi, Illustr. Fl. Mitteleur. 2: 39, f. 196 (1909); Rouy, Fl. France 13: 363 (1912); Svenson in Rhodora 31: 211 (1929) & in N. Amer. Fl. 18 (9): 519 (1957).



*Scirpus capitatus* Schreb., Spic. Fl. Lips. 60 (1771), non Linn. (1753).—*Scirpus ovatus* Roth, Tent. Fl. Germ. 2 (2): 562 (1793) & Catal. 1: 5 (1797); Aschers. & Graebn., Synops. Mitteleur. Fl. 2 (2): 292 (1904).—*Scirpus compressus* Ehrh., Beitr. 4: 155 (1789); Moench, Meth. 349 (1794), non Pers. (1805).—*Scirpus annuus* Thuill., Fl. Paris ed. 2, 22 (1799), non All. (1785), nec. Host (1801).—*Scirpus soloniensis* Dubois, Meth. 295 (1803).—*Scirpus natans* Bergeret, Fl. Pyr. 1: 43 (1803).—*Scirpus turgidus* Pers., Synops. 1: 66 (1805).—*Scirpus multicaulis* Gmelin, Fl. Bad. 1: 96 (1805), non Sm. (1800), nec. Muell. ex Clarke (1908).—*Bulbostylis ovata* (Roth) Steven in Mém. Soc. Imp. Nat. Moscou 5: 335 (1813).—*Clavula ovata* (Roth) Dumortier, Fl. Belg. 143 (1827).—*Eleogenus ovatus* (Roth) Nees in Linnaea 9: 294 (1834), nomen.—*Cyperus ovatus* (Roth) Missbach & Krause in Strum, Fl. Deutsch. ed. 2, 2: 25, t. 1 (1900).—*Trichophyllum ovatum* Farwell, in Rep. Mich. Acad. Sci. 21: 358 (1920).—*E. annua* (Thuill.) House in N. Y. State Mus. Bull. No. 243-244, 58 (1923), non Karst. (1880-83).—*E. soloniensis* (Dubois) Hara in Journ. Jap. Bot. 14: 338 (1938); Ohwi, Cyper. Japon. 2, 42 (1944).—*E. soloniensis* Hara var. *nipponica* Hara in Journ. Jap. Bot. 14: 338 (1938); Ohwi, Cyper. Japon. 2, 43 (1944) in descr., & Fl. Japan 225 (1953).—*E. ovata* Römer & Schult. var. *nipponica* Hara, l. c., pro syn.

Hokkaido: Ishikari, Lake Shumarinai, nr. Shirakaba. Y. Asai & T. Koyama 14088 (Auct. herb. !); Kitami, Lake Abashiriko. S. Miki (KYO!)—Honshu (Northeast district, Lake Yamana-kako, Lake Kawaguchiko, Karuizawa, Lake Shirakomaike in Shirano).—Widespread in temperate and cooler regions of N. Hemisphere. Wet soil along shore of lake on high mountains, usually forming pure colony. Japanese name: *Maruho-harii*.

Some authors have recently used the combination, *Eleocharis soleniensis* (Dubois), for *E. ovata* (Roth, 1793), because there is an earlier homonym, *E. ovata* (Gilib., 1792), which is *E. palustris*. However, the validity of *Scirpus ovatus* Gilibert (Exerc. Phyt. 512, 1792) was rejected by McVaugh in Gent. Herb. 8: 87-90 (1949), so that all binomials depending on *S. ovatus* Gilib. are invalid.

**45. *Eleocharis geniculata*** (Linn.) Römer & Schultes, Syst. Veg. 2: 150 (1817); Svenson in Rhodora 41: 50 (1939); S. T. Blake in Proc. Roy. Soc. Queensl. 50: 124, t. 10, f. 29-31 (1939).

*Scirpus geniculatus* Linn., Sp. Pl. ed. 1, 48 (1758), pro pte.—*Scirpus caribaeus* Rottb., Descr. Pl. Rar. Progr. 24 (1772) & Descr. et Icon. 46, t. 15, f. 3 (1773).—*E. capitata* R. Br., Prodr. Fl. Nov. Holl. 1, 225 (1810); Safford in Contrib. U. S. Nat. Herb. 9: 267 (1905); Merrill in Philip. Journ. Sci. 9: 60 (1914); Domin in Biblioth. Bot. 20, Heft. 85, 446 (1915).—*E. setacea* R. Br., Prodr. Fl. Nov. Holl. 1, 225 (1810), non R. Br., l. c. 224 (1810).—*E. caduca* Schultes in Römer & Schult., Syst. Veg. Mant. 2: 88 (1824).—*E. Brownii* Sprengel, Syst. 2: 204 (1825).—*Eleogenus capitatus* (R. Br.) Nees ex Wight, Contrib. Bot Ind. 112 (1834).—*E. microformis* Buckl. in Proc. Acad. Philadelph. 1862: 10 (1862).—*E. dispar* E. J. Hill in Bot. Gaz. 7: 3 (1882).—*Chlorocharis capitata* (R. Br.) Rikli in Pringsh., Jahrb. 27: 564 (1895).—*E. caribaea* (Rottb.) S. F. Blake in Rhodora 20: 24 (1918); Svenson in Rhodora 31: 225 (1929) & in North Amer. Fl. 18 (9): 520 (1957); Ohwi, Cyper. Japon. 2, 44 (1944); T. Koyama in Contrib. Inst. Bot. Univ. Montréal 70, 37 (1957).—*E. caribaea* S. F. Blake var. *Stokesii* F. B. H. Brown in Bishop Mus. Bull. 84: 106 (1931).

Ryukyus: Is. Okinawa, without definite locality. S. Sakagachi 21 (TI!), T. Miyagi (TI!); Awase. S. Tawada 71 (KYO!); Higashison, Arume. T. Koyama 7366 (auct. herb. !); Nago. T. Miyagi (KYO!)—Formosa: In paludibus Tamsui. U. Faurie 795 (KYO!); between Shochikaku



and Gaïen. B. Hayata. (TI!); Ad flumen Shimotansui. S. Miki (KYO!); Taiton Hsien, Tashikan. Kawakami & Nakahara 740 (TI!); Taiton Hsien, Hakuhakusha. Kawakami & Kobayashi 1942 (TI!).—Tropical regions of both hemispheres. Open marshy places, often near the sea.

Because the Linnaeus' *Scirpus geniculatus* is a mixture of two different species, the application of the name, *Eleocharis geniculata*, has been quite unsettled. The only specimen which Linnaeus saw and from which he must have drawn his description, is *Scirpus caribaeus* Rottb. And the epithet *geniculatus* was derived from the Sloan plates including two figures. According to C. B. Clarke (in Journ. Linn. Soc. 30: 309-310. 1894), one of the two, tab. 81, fig. 3, is *Scirpus caribaeus* Rottb., another, t. 75, fig. 2, being *Eleocharis elegans*. Concerning the application of *E. geniculata*, Svenson changed his opinion twice. In Rhodora 39: 259-262, he retained *E. geniculata* in *E. caribaea* of America, and afterward, he attributed it to *E. caribaea* (l. c. 41: 50-52). Recently, he again cited it under *E. elegans* on the ground that in Sp. Pl. ed. 2, Linnaeus restricted *Scirpus geniculatus* to *E. elegans*. There is a reason on both sides. In this treatment, I took his second opinion, because I think that the specimen which Linnaeus saw, and on which Linnaeus' description, *Scirpus culmo nudo, spica terminatrice subrotunda*, was based, should be accepted as the type. But, because both species have a quite commonly used name respectively (*E. caribaea* and *E. elegans*), it may be better to treat the name, *Scirpus geniculata*, as 'nomen omnino delendum'.

46. *Eleocharis atropurpurea* (Retz.) Presl, Reliq. Haenk. 1: 196 (1828); F. v. Mueller, Fragm. Phytogr. Austral. 8: 240 (1874); Bentham, Fl. Austral. 7: 296 (1878); Britton in Journ. N. Y. Micr. Soc. 5: 101 (1889); Hegi, Illustr. Fl. Mitteleur., 2: 39 (1909); Domin in Bibl. Bot. 20, Heft. 85, 446 (1915); Svenson in Rhodora 31: 227, f. 49 (1929), & in North Amer. Fl. 18 (9): 521 (1957); S. T. Blake in Proc. Roy. Soc. Queensl. 50: 125, t. 10, f. 32-33 (1939); Chermeson in Humbert, Fl. Madagascar 29<sup>e</sup> fam., Cypér., 210 (1937); Ohwi, Cyper. Japon. 2, 43 (1944).

*Scirpus atropurpureus* Retz., Obserb. 5, 14 (1789); Reichenb., Icon. Fl. Germ. 8: 37, t. 295, f. 699 (1846).—*Isolepis atropurpurea* (Retz.) Römer & Schult., Syst. Veg. 2: 106 (1817).—*Eleogenus atropurpureus* (Retz.) Nees ex Wight, Contirb. Bot. Ind. 113 (1834).—*Eleocharis Lereschii* Shuttl. in Flora 20: 241 (1837).—*Scirpus erraticus* Rota ex De Not. in Ann. Sci. Nat. Ser. 3, 5: 366 (1846).—*Isolepis setifolia* A. Rich., Tent. Fl. Abyss. 2: 498 (1852).—*E. Zanardinii* Parl., Fl. Ital. 2: 67 (1852).—*E. monandra* Hochst ex Steudel, Synops. Pl. Glum. 2: 75 (1855).—*Isolepis allochloa* & *dichloa* Steudel, Synops. Pl. Glum. 2: 91 (1855).—*E. multiflora* Champ., Fl. South. U. S. 517 (1860).—*Trichophyllum atropurpureum* (Retz.) House in Amer. Midl. Natur. 6: 204 (1920).—*E. atropurpurea* Presl var. *Hashimotoi* Ohwi in Act. Phytotax. Geobot. 1: 18 (1932) & Fl. Japan 225 (1953).

Honshu: Ohmi, Zeze. Ch. Hashimoto (KYO!, TNS!); Suwo, Ouchimura. J. Nikai (TNS!)—Kyushu: Higo, Taragi. K. Mayebara (KYO!); Satsuma, Taniyama near Kagoshima. T. Fukuzawa (TNS!); Kagoshima, Kamoike. S. Kawagoc. (KAG!).—Formosa: Kaoshiung. Y. Shimada 4434 (KYO!)—Tropics of the Old World, Italy, Switzerland, S. United States. Wet sandy soil, often near the sea.

The combination, *E. atropurpurea* (Retz.), has been attributed to Kunth (1837), however, Presl had made it already about ten years earlier.

**47. *Eleocharis palustris*** (Linn.) Römer & Schultes, Syst. Veg. 2: 151 (1817); Fern. & Brackett in Rhodora 31: 59 (1929).

*Scirpus palustris* Linn., Sp. Pl. ed. 1, 47 (1753).—*Bulbostylis palustris* (Linn.) Steven in Mém. Soc. Imp. Nat. Mosc. 5: 355 (1814).—*Clavula palustlis* (Linn.) Dumortier, Fl. Belg. 143 (1827).—*Chlorocharis palustris* (Linn.) Rikli in Jahrb. W. Bot. 27: 564 (1895).—*Scirpus eupaluster* Lindb. f. in Act. Soc. Fauna & Fl. Fenn. 23 (7): 4 (1902).—*E. eupalustris* Lindb. f. in Act. Soc. Fauna & Fl. Fenn. 23 (7): 5 (1902).—*Scirpus paluster* Ascherson & Graebn., Synops. Mitteleur. Fl. 2 (2): 289 (1903).—*Scirpus paluster* Ascher. & Graebn.  $\alpha$ . *typicus* Aschers. & Graebn., Synops. Mitteleur. Fl. 2 (2): 290 (1903).—*E. palustris* Römer & Schult. var. *typica* (Aschers. & Graebn.) Rouy, Fl. France 13: 361 (1912); Fern. & Brackett in Rhodora 31: 60, t. 181, f. 1-4 (1929).—*Trichophyllum palustre* (Linn.) Farwell in Rep. Mich. Acad. Sci. 15: 166 (1913).

Chromosomes:  $2n=16, 36, 38, 46$ .

Circum-boreal.

var. **major** Sonder, Fl. Hamb. 22 (1851); Fern. & Brackett in Rhodora 31: 61, t. 181, f. 5-7 (1929).

*E. palustris* Römer & Schult. a *aquatilis* Schur, Enum. Pl. Transs. 690 (1866).—*E. crassa* Fischer & Meyer (ex Böckeler in Bull. Soc. Nat. Moscou 1: 75. 1858. nomen) ex Meinsh. in Act. Hort. Petropol. 18: 262 (1901); Zinserling in Komar., Fl. URSS. 3: 77, t. 6, f. 11 & 582 (1935).—*Scirpus crassus* C. A. Meyer ex Meinsh. in Act. Hort. Petropol. 18: 262 (1901).—‘*E. palustris* Römer & Schult.’: C. B. Clarke ex Léveillé in Bull. Acad. Intern. Géogr. Bot. 14: 203 (1903) saltem p. p.; Matsumura, Index Pl. Japon. 2 (1): 146 (1905), ex p.; Miyabe & Kudo, Fl. Hokkaido & Saghal. 2: 208 (1931); Ohwi in Act. Phytotax. Geobot. 2: 271 (1933).—*E. intersita* Zinserling in Komar., Fl. URSS. 3: 76, t. 6, f. 11, 26, & 581 (1935); Kitagawa, Lineam. Fl. Manshur. 119 (1939); Ohwi, Cyper. Japon. 2, 48 (1944) & Fl. Japon 226 (1953), syn. nov.

Saghalien, Kuriles, Hokkaido, Honshu (northeastern district)—Siberia, N. Europe, N. America. Moor. Japanese name: *Kuro-numaharii*.

After a careful comparison, I failed to find any difference between *E. intersita* of the Far East and *E. palustris* of Europe. In 1935, Zinserling created quite a lot of species of *E. palustris* and *E. uniglumis* groups, chiefly based upon the shape of spongy stylebase. According to my observations made on European, Asiatic, and American materials of *E. palustris*, the shape of stylebase is very variable. In European and American plants, it is said that the stylebase are narrower than those of Asiatic plants. But, in European plants, shape of stylebase varies from narrowly subulate-conical to broadly deltoid even in the same spikelet. It is the same thing in American and Asiatic plants. When Zinserling described *E. intersita*, he indicated that the perianth bristles of this species are longer than in *E. palustris*. In typical European *E. palustris*, perianth bristles hardly exceed the stylebase. In Asiatic plants, the length of bristles is not constant, sometimes they distinctly exceed the stylebase, and sometimes they are reduced to half as long as the achene. I believe that *E. intersita* of Asia is conspecific with *E. palustris*, as Ohwi supposed in his early paper on *Eleocharis* (l. c. 1933). Var. *major* is fairly well characterized by softer, thick culms, larger floral scales with broader hyaline margins. *E. quaesita* from Japan is, so far as the type is concerned,

separable from *E. palustris* only by broader, rounded stylebase, which shows an intermediate shape between that of *E. palustris* and that of *E. mamillata*. At least it is not a separate species from *E. palustris*, because the other characters including floral scales are almost the same as *E. palustris* var. *major*. I keep it as a variety for the time being.

var. **quaesita** (Kitagawa) T. Koyama, stat. nov.

*E. quaesita* Kitagawa in Journ. Jap. Bot. **27**: 202 (1952).

Honshu: Ugo, Yamase-mura. G. Koie (Holotype of *E. quaesita* in TI!).

var. **parvinux** (Ohwi) T. Koyama, stat. nov.

*E. parvinux* Ohwi, Cyper. Japon. **2**, 47 (1944) & Fl. Japan **225** (1953).—‘*E. palustris* Römer & Schult.’: Matsumura, Index Pl. Japon. **2** (1): 145 (1905), ex p.

Honshu (Kwanto district). Marshy places in lowlands. Japanese name: *Kotsubu-numaharii*.

Small achenes 0.9-1.2 mm long and slender, hard culms characterize this variety. North American *E. Smallii* is somewhat similar to var. *parvinux*, but differs by more sparsely spinulose perianth bristles.

**48. *Eleocharis mamillata*** Lindb. fil. in Act. Soc. Fauna & Fl. Fenn. **23**: 7 (1902); Fern. & Brackett in Rhodora **31**: 66 (1929); Zinserling in Komar., Fl. URSS. **3**: 75, t. 6, f. 8 (1935); Ohwi, Cyper. Japon. **2**, 46 (1944).

*E. ussuriensis* Zinserling in Komar., Fl. URSS. **3**: 75, t. 6, f. 9, & 581 (1935), syn. nov. —*E. mamillata* Lindb. fil. var. *cyclocarpa* Kitagawa, Lineam. Fl. Manshur. **119** (1939); Ohwi, Cyper. Japon. **2**, 46 (1944) & Fl. Japan **225** (1953), syn. nov. —*E. cyclocarpa* Kitagawa, Lineam. Fl. Manshur. **119** (1939), pro syn.

Chromosomes:  $2n=16$ .

Saghalien, Kuriles, Hokkaido, Honshu, Kyushu, Korea—Siberia, Europe. Marshy places chiefly on mountains. Japanese name: *Numa-harii*.

I do not separate the Far Eastern population of this species even as a variety. Both *E. cyclocarpa* and *E. ussuriensis* were separated by slightly slender stylebase. The shape of stylebase and the length of perianth bristles are very variable in the genus *Eleocharis*, especially in *E. palustris* group, and in my opinion these characters are of less taxonomical importance. *E. mamillata* differs clearly from *E. palustris* var. *major* by very soft culms easily strongly compressed when dry, and round stylebase always wider than long.

**49. *Eleocharis valleculosa*** Ohwi in Act. Phytotax. Geobot. **2**: 29 (1933); Kitagawa, Lineam. Fl. Manshur. **121** (1939); Ohwi, Cyper. Japon. **2**, 47 (1944) & Fl. Japan **225** (1953).

‘*E. palustris* Römer & Schult.’: G. B. Clarke ex Lévillé in Bull. Acad. Intern. Géogr. Bot. **14**: 203 (1904), quoad specim. Furie 691; Nakai, Fl. Korean **2**: 297 (1911), ex p.

Honshu: Kai, Lake Kawaguchiko. J. Ohwi & T. Koyama, 5883 (auct. herb.!)—Kyushu: Satsuma, Ijuin. Y. Doi (KYO!); Hiuga, Miyazaki. S. Wakabayashi. (KYO!)—Korea, Manchuria, China. Japanese name: *Suji-numaharii*.

Perianth bristles are usually wanting. A form with elongated bristles is: forma **setosa** (Ohwi) Kitagawa, Lineam. Fl. Manshur. **121** (1939).

*E. valleculosa* Ohwi var. *setosa* Ohwi in Act. Phytotax. Geobot. **2**: 29 (1933).

This is a good example of the species of Japanese-Chinese link. Achenes brownish at maturity, and more or less glaucous, several-ridged hard culms clearly define this plant from any other species of *E. palustris* group.

**50. *Eleocharis kamtschatica*** (C. A. Mey.) Komarov, Fl. Penins. Kamtschat. **1**: 207 (1927); Ohwi, Cyper. Japon. **2**, 44 (1944) & Fl. Japan 225 (1953); Svenson in North Amer. Fl. **18** (9): 524 (1957).

*Scirpus kamtschaticus* C. A. Meyer in Mém. Acad. St.-Petersb. Sav. Etr. **1**: 193 (1831).—*E. pileata* A. Gray in Mem. Amer. Acad. N. S. **6**: 417 (1859), p. p.—‘*E. uniglumis* Schlut.’: F. Schmidt, Reisen Amurl. u. Ins. Sachal. 190 (1868); Komar., Fl. Maushur. **1**: 349 (1901); Miyabe & Kudo, Fl. Hokkaido & Saghal. **2**: 209 (1931).—*Scirpus mitratus* Franch. & Savat., Enum. Pl. Japon. **2**: 111 (1876) & 544 (1879).—*Eleocharis mitrata* (Franch. & Savat.) Mikino in Bot. Mag. Tokyo **8**: 260 (1901).—*Eleocharis Savatieri* C. B. Clarke (ex Léveillé in Bull. Acad. Intern. Géogr. Bot. **14**: 203, 1940 nomen nudum; Matsumura, Index Pl. Japon. **2** (2): 146, 1905 nomen seminud.) in Kew Bull. Add. Ser. **8**, 21 (1908) & Ill. Cyperac. t. 36, f. 15-18 (1909).—*E. triflora* Komarov in Fedde, Repert. **13**: 162 (1914), non Böckl. (1880)—*E. sachalinensis* (Meinsh.) Komarov in Komar. & Alisova, Key Pl. Far East. Reg. URSS. **1**: 266 (1931).—*E. Komarovii* Zinserling in Komar., Fl. URSS. **3**: 81 (1935).—*E. Kamtschatica* Komar. forma *typica* Ohwi, Cyper. Japon. **2**, 45 (1944) in descr.

Saghalien, Kuriles, Hokkaido, Honshu (central district and northeastwards), Kyushu (n. part), Korea—Ussuri Kamtschatka, North America (Alaska, Quebec, Lador). Wet sandy places along sea coast. Japanese name: *Kuro-harii*.

In plants from Honshu and Kyushu, Japan, perianth bristles are usually absent. This form is called:

forma **reducta** (Ohwi) Ohwi, Cyper. Japon. **2**, 45 (1944) & Fl. Japan 225 (1953).

*E. kamtschatica* Komar. var. *reducta* Ohwi in Bot. Mag. Tokyo **45**: 184 (1931).

A distinct species of *E. uniglumis* group by the swollen stylebase slightly larger than the body of achene.

**51. *Eleocharis Kuroguwai*** Ohwi in Journ. Jap. Bot. **12**: 654 (1936), Cyper. Japon. **2**, 33 (1944) & Fl. Japan 223 (1953).

‘*Scirpus plantagineus* Retz.’: Franch. & Savat., Enum. Pl. Japon. **2**: 111 (1876).—‘*E. plantaginea* Römer & Schult.’: Matsumura, Index, Pl. Japon. **2** (1): 146 (1905), saltem. p. p. maj.—‘*E. dulcis* Trin.’: Svenson in Rhodora **31**: 158, quoad Pl. Jap. incl. t. 188, f. 16 (1929).

Honshu (Kwanto district and westwards), Shikoku, Kyushu, Korea. In shallow water in pond. Japanese name: *Kuro-guwai*.

A Japanese endemic. It is no doubt that *E. Kuroguwai* is a good species, though some authors badly treated it as being identical with *E. dulcis* (= *E. plantaginina*). It is distinctly separable from the latter by looser coriaceous floral scales rounded at apex, conspicuously annulate achenes with narrower stylebase, and spikelets gradually narrowed at the apex.

**52. *Eleocharis dulcis*** (Burm. fil.) Trinius ex Henschel, Vita Rumph. 186 (1833); Svenson in Rhodora **31**: 158 (1929), p. p. excl. fig. & **41**: 11, t. 537, f. 6 (1936), excl. syn. *E. equisetina* Presl; S. T. Blake in Proc. Roy. Soc. Queensl. **50**: 103, t. 8, f. 6-9 (1939); Ohwi, Cyper. Japon. **2**, 32 (1944) & Fl. Japan 223 (1953); T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 36 (1957).



[*Cyperus dulcis* Rumphius, Herb. Amb. 6: 7, t. 3, f. 1 (1750)]—*Andropogon dulce* Burman, fil., Fl. Ind. 219 (1768).—*Scirpus plantaginoides* Rottb., Descr. & Jcon. 45, t. 15, f. 2 (1773).—*Hippuris indica* Loureiro, Fl. Conhinch. 16 (1790).—*Scirpus plantagineus* Retz., Observ. 5, 14 (1799).—*Scirpus tumidus* Roxburgh (Hort. Beng. 81. 1814) Fl. Ind. ed. 1, 1: 215 (1820).—*E. plantaginea* (Retz.) Römer & Schult., Syst. Veg. 2: 150 (1817); Thwaites, Enum. Pl. Zeyl. 352 (1854); C. B. Clarke in Dur. & Schinz., Consp. Fl. Afr. 5: 600 (1895); Chermezon in Humbert, Fl. Madagascar 29<sup>e</sup> fam., Cypér., 205 (1937).—*E. tumida* (Roxb.) Römer & Schult., Syst. Veg. 2: 86 (1824).—*E. plantaginoides* (Rottb.) W. F. Wight, Contrirb. U. S. Nat. Herb. 9: 267 (1905), non *E. plantaginoides* (Rottb.) Domin (1915).

Honshu: Kii, Arimaïke in Koshiyama village. T. Koyama 5754. (auct. herb.!), Shinjo. T. Nakashima. (KYO!); Shima, Funakoshi-mura. T. Magofuku (KYO!)—Kyushu: Chikuzen, Seto-mura. K. Nakajima 176 (KYO!)—Ryukyus (Is. Okinawa, Is. Miyako), Formosa—Africa, India, Central & S. China, Malaysia, Australia, New Caledonia, Fiji. Shallow water in pond. Scarce. Japanese name: *Shiro-guwai*.

var. **tuberosa** (Roxb.) T. Koyama, stat. nov.

*Scirpus tuberosus* Roxburgh (Hort. Beng. 81. 1841. nomen) Fl. Ind. ed. 1, 1: 215 (1820), non Desf. (1800).—*E. tuberosa* (Roxb.) Römer & Schult., Syst. Veg. Mant. 2: 86 (1924).—*E. esculenta* Viellard in Ann. Sci. Nat. 4<sup>e</sup> sér., 16: 37 (1852).

Honshu: Kobe, Myohoji (cult.). T. Koyama 68 (auct. herb.!)—China. Vern. name: *Chinese Water Chestnut*.

A variety with depressed-globose tubers up to 4 cm across, 2.5 cm tall, and clothed with thin dark purple scales. Cultivated as vegetable for Chinese meal.

**53. *Eleocharis chrostachys*** Steudel, Synops. Pl. Glumac. 2: 80 (1855); C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 626 (1893); Ohwi, Cyper. Japon. 2, 32 (1944).

*Scirpus laxiflorus* Thwaites, Enum. Pl. Zeyl. 435 (1864).—*E. subulata* Böckl. in Flora 41: 412 (1858); Koorders, Exkursionsfl. Java 1: 197 (1911).—*E. variegata* (Poir.) Presl var. *laxiflora* (Thw.) Ridley in Journ. Asiat. Soc. Sing. 23: 14 (1891), comb. nud.—*E. variegata* Presl var. *laxiflora* (Thw.) C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 626 (1893) & in Dur. & Schinz., Consp. Fl. Afr. 5: 601 (1895); Svenson in Rhodora 31: 157 (1929).—*E. laxiflora* (Thw.) H. Pfeifer in Mitt. Inst. Bot. Hamburg 7: 169 (1928); Svenson in Rhodora 41: 8, t. 537, f. 3 (1939).

Ryukyus (Okinawa, Miyako, Iriomote), Formosa—India, Malaysia, Micronesia, Samoa.

**54. *Eleocharis fistulosa*** (Poir.) Link ex Sprengel, Jahrb. 3: 78 (1820); Fernald in Rhodora 27: 39, t. 149, f. 5-10 (1925); Svenson in Rhodora 31: 152, t. 188, f. 3 (1929) & in North Amer. Fl. 18 (9): 511 (1957); T. Blake in Proc. Roy. Soc. Queensl. 50: 96, t. 7, f. 1-3 (1939); Chermezon in Humbert, Fl. Madagascar 29<sup>e</sup> fam., Cypér., 207 (1937); Ohwi, Cyper. Japon. 2, 31 (1944) & Fl. Japan 223 (1953); T. Koyama in Contrib. Inst. Bot. Univ. Montréal 70, 36 (1957).

*Scirpus fistulosus* Poir., Encycl. Meth. 6: 749 (1804), non Forsk. (1775).—*Scirpus actangulus* Roxb. (Hort. Beng. 81. 1814. nomen) Fl. Ind. ed. 1, 1: 216 (1820).—*Scirpus medius* Roxb., Fl. Ind. ed. 1, 1: 216 (1820), non S. F. Gray (1821).—*E. actangula* (Roxb.) Schultes in Römer & Schult., Mant. 2: 91 (1824).—*Baeothryon fistulosum* (Poir.) A. Dietrich, Sp. Pl. 2: 94 (1833).—*Limnochloa actangula* & *media* (Roxb.) Nees ex Wight, Contrib. Bot. Ind. 114 (1834).—*Limnochloa fistulosa* (Poir.) Nees in Linnaea 9: 294 (1854), comb. nud.—*Limnochloa obtusetrigona* Lindl. & Nees in Martius, Fl. Brasil. 2 (1): 100 (1842).—*Eleocharis planiculmis* Steudel, Synops. Pl. Gl. 2: 80 (1855).—*E. mutata* Römer & Schult. var. *obtusetrigona* (Lindl.

& Nees) C. B. Clarke in Bull. Herb. Boiss. 6, Append. 1, 20 (1898).

Honshu: Kii, Nagaidani valley near Shinjo. T. Koyama 5885 (TI!), Tanabe. N. Ui (KYO!)  
—Kyushu: Buzen, Osadaike. Z. Tashiro (KYO!)—Ryukyus (Okinawa, Miyako, Is. Ikema),  
Formosa—India, Indo-China, Central & S. China, Malaysia, N. Australia, West Indies, S.  
America. Japanese name: *Misumi-i*.

This appears to be closest to *E. philippinensis* Svens. and *E. spiralis* R. & S. The former differs from it by relatively smaller achenes with larger neck, more hexagonal external cells, and 6 to 7 bristles of more unequal length, and the latter by not constricted achenes and broader scales.

#### PROBABLE NATURAL HYBRID

(8) *Eleocharis* × *yezoensis* Hara in Bot. Mag. Tokyo 52: 396 (1938), spec. propr.  
*E. Wichurai* Böckl. × *E. congesta* D. Don var.

*E. tetraquetra* Nees var. *yezoensis* Hara in Bot. Mag. Tokyo 52: 396 (1938), pro syn.—*E. Wichurai* Böckl. var. *yezoensis* (Hara) Ohwi, Cyper. Japon. 2, 39 (1944).

Hokkaido: Hidaka, Mt. Apoi. H. Hara (Type of *E. yezoensis* in TI!)—Honshu: Shimotsuke  
Utsunomiya. H. Sekimoto. (Auct. herb.!) ; Kai, Mt. Howozan, Takanota. Ch. Iwata 63 (Auct.  
Herb.!).

I suppose *E. yezoensis* to be a natural hybrid between *E. Wichurai* and *E. congesta* var. Outwardly it is closest to *E. congesta* var. *subvivipara*, but is differing therefrom by more elliptic spikelets always rounded at the apex. The three specimens cited here morphologically well agree with each other. Strictly speaking, the specimen from Hidaka will be a hybrid between *E. Wichurai* and *E. congesta* var. *thermalis*, while it is more likely that the two specimens from Honshu are a hybrid between *E. Wichurai* and *E. congesta* var. *japonica*.

#### Genus 4. FIMBRISTYLIS Vahl.

The morphological uniformity of *Fimbristylis* makes it very difficult to circumscribe the infrageneric groups such as sections or series. The genus was generally classified quite artificially by the number of stylearms before Ohwi proposed a system chiefly based upon the Asiatic species in 1938. It is worthwhile to mention that, in his system, after careful observations of the digyny and trigyny of pistils, Ohwi much revised the meaning of *Dichelostylis* and *Trichelostylis* in the traditional sense. The 14 groups proposed by Ohwi in this work have been accepted generally as natural, and Kern (1955) typified them in accordance with the recent International Rules of Botanical Nomenclature, with a few changes. The arrangement of the groups accepted here agrees with Ohwi and Kern in broad outline except for several changes stated below, however, having failed to delimit the subgenera, I treated all groups of *Fimbristylis*, s. str. with the rank of series. The reason why I included *Bulbostylis* in *Fimbristylis* s. l. was stated in the part 1 of this paper.

A morphological correlation was found between the number of stylearms and the keel of floral scales. In plants having true trigynous pistil, keel of scales is always sharply convexed outside, thus the spikelets are angular and relatively

loosely flowered. In these plants, leaf sheaths become bilaterally compressed, when they are 2-ranked. In those with true digynous pistil, keel of scales appears as a slender nerve, so that the scales are flat outside and spikelets are terete and densely flowered. In this case, leaf sheaths are also cylindrical even if they are 2-ranked. For this reason, *Globulosae* is placed rather near to *Dichelostylis* than to *Trichelostylis*, so as *Leptocladae*, too. Because, in *Abildgaardia*, achenes are triangular with one side facing the rachilla and are not like those of *Pycneus*, in which one ridge of achene faces the rachilla. The 2-ranked scales of *Abildgaardia* are not accepted here as a very important character. In my opinion, *Abildgaardia* seems to be an extreme group of *Trichelostylis* s. lat.

Subgenus 1. **Bulbostylis** (Kunth) T. Koyama, stat. nov.

Gen. *Bulbostylis* Kunth, Enum. Pl. 2: 108 (1837).

Type: *Bulbostylis capillaris* Kunth (= *Fimbristylis capillaris* Gray).

Subgenus 2. **Fimbristylis**, section A. **Fimbristylis**.

Ser. a. **Heleocharoides** (Benth) T. Koyama, stat. nov.—Sect. *Heleocharoides* Benth., Fl. Austral. 7: 301 (1878). Type: *F. pauciflora* R. Br.

Ser. b. **Autumnales** Ohwi, Cypér. Japon. 2, 53 (1944) in clave—Gen. *Trichelostylis* Lestib., Ess. Fam. Cypér. 40 (1819)—*Isolepis* sect. *Trichelostylis* (Lestib.) Endl., Gen. Pl. 118 (1836)—*Fimbristylis* subgen. *Trichelostylis* (Lestib.) A. Gray, Man. Bot. ed. 5, 567 (1867)—Sect. *Trichelostylis* (Lestib.) Böckeler in Linnaea 37: 23 (1871). Type: *F. autumnalis* Römer & Schult.

Ser. c. **Cymosae** (Ohwi) Ohwi, Cyper. Japon. 2, 54 (1944) in clave.—Sect. *Cymosae* Ohwi in Journ. Jap. Bot. 14: 571 (1938). Type: *F. cymosa* R. Br.

Ser. d. **Miliaceae** (Ohwi) Ohwi, Cyper. Japon. 2, 54 (1944) in clave—Sect. *Miliaceae* Ohwi in Journ. Jap. Bot. 14: 572 (1938). Type: *F. miliacea* (Linn.) Vahl.

Ser. e. **Globulosae** (Ohwi) Ohwi, Cyper. Japon. 2, 54 (1944) in clave—Sect. *Globulosae* Ohwi in Journ. Jap. Bot. 14: 572 (1938). Type: *F. globulosa* (Retz.) Kunth.

Ser. f. **Leptocladae** (Ohwi) Ohwi, Cyper. Japon. 2, 54 (1944) in clave—Sect. *Leptocladae* Ohwi in Journ. Jap. Bot. 14: 572 (1938). Type: *F. leptoclada* Benth.

Ser. g. **Fimbristylis**.—Sect. *Eufimbristylis* Böckl. in Linnaea 37: 3 (1871)—*Neodichelostylis* E. G. Camus in Lecomte, Fl. Génér. Indo-Chine 7: 89 (1912)—Sect. *Dichotomae* & *Ferrugineae* Ohwi in Journ. Jap. Bot. 14: 573 (1938)—Ser. *Dichotomae* & *Ferrugineae* Ohwi, Cyper. Japon. 2, 55 (1944) in clave—Sect. *Rigidulae* Kern in Blumea 8: 161 (1955). Type: *F. dichotoma* (Linn.) Vahl.

Ser. h. **Squarrosae** (Ohwi) Ohwi, Cyper. Japon. 2, 55 (1944) in clave—Gen. *Pogonostylis* Bertol., Fl. Ital. 1: 312 (1833)—Sect. *Pogonostylis* (Bertol.) Pax. in Engl. & Pr., Nat. Pflanzenf. 2: 113 (1887)—Sect. *Squarrosae* Ohwi in Journ. Jap. Bot. 14: 573 (1938). Type: *F. squarrosa* Vahl.

Ser. i. **Nutantes** Ohwi, Cyper. Japon. 2, 55 (1944) in clave—Sect. *Nutantes* Ohwi in Journ. Jap. Bot. 14: 573 (1938). Type: *F. nutans* (Retz.) Vahl.

Ser. j. **Monostachyae** Ohwi, Cyper. Japon. 2, 53 (1944)—*Abildgaardia* Vahl, Enum. 2: 296 (1806)—*Cyperus* sect. *Abildgaardia* (Vahl) Ehdl., Gen. Pl. 119 (1836)—Sect. *Abildgaardia* (Vahl) Benth., Fl. Austral. 7: 299 (1878)—Sect. *Fuscae* Ohwi, Cyper. Japon. 2, 53 (1944) in clave. Type: *F. monostachyos* (Linn.) Hassk.

Section B. **Mischospora** (Böckl.) E. G. Camus in Lecomte, Fl. Génér. Indo-Chine 7: 89 (1912)—*Mischospora* Böckeler in Flora 43: 113 (1860).—Sect. *Tetragonae*

Ohwi in Journ. Jap. Bot. 14: 571 (1938).

Ser. k. **Mischospora**. Type: *F. teragona* R. Br.

Ser. l. **Echinolytrum** (Desv.) T. Koyama, stat. nov.—Gen. *Echinolytrum* Desv. in Journ. de Bot. 1: 20 (1808)—Sect. *Dipsaceae* Ohwi in Journ. Jap. Bot. 14: 571 (1938)—Sect. *Echinolytrum* (Desv.) Ohwi, Cyper. Japon. 2, 53 (1944) in clave. Type: *Echinolytrum dipsaceum* Desv. (= *Fimbristylis dipsacea* C. B. Clarke).

1. Stylebase distinct, persistent at apex of achene. (Subg. BULBOSTYLIS).
  2. Floral scales brown to fuscous, ciliate and puberulent upper, mucous at apex; achenes grayish, punctulate. .... 55. *F. capillaris*
  2. Floral scales straw-coloured to yellow-brown, glabrous, keel excurrent to awn; achenes light yellowish, smooth. .... 56. *F. barbata*
1. Stylebase indistinctly thickened, falling off apart from the body of achene. (Subgen. FIMBRISTYLIS).
  3. Achenes obovoid or obdeltoid-obovoid. (§ **Fimbristylis**).
  4. Floral scales spirally imbricate.
    5. Stigmas 3 (rarely 2), style trigonous not flattened, smooth; floral scales sharply to obtusely convexed outside with prominent keel; leaf-sheaths bilaterally compressed when 2-ranked.
      6. Spikelet solitary, terminal; scales few, erect or nearly so. (Ser. *Heleocharoides*).  
..... 57. *F. pauciflora*
      6. Spikelets more than several, many-flowered.
      7. Cauline leaves bladed.
        8. Ligule of a fringe of pubescence; achenes light stramineous; stigmas definitely 3. (Ser. *Autumnales*).
          9. Leaves 2-ranked, bilaterally compressed.
            10. Floral scales 1.5–2 mm long. .... 58. *F. autumnalis*
            10. Floral scales more than 3 mm long. .... 59. *F. complanata*
          9. Leaves not bilaterally compressed; floral scales 3.5 mm long.  
..... 60. *F. Thomsonii*
        8. Ligule none; achenes brownish to black-brown, stigmas 3 or 2. (Ser. *Cymosae*).
          11. Rhizome stoloniferous. .... 61. *F. Pierotii*
          11. Rhizome tufted without stolon.
            12. Leaves densely pubescent; spikelets dark grayish-stramineous, 6–10 mm long. .... 62. *F. sericea*
            12. Leaves glabrous, coriaceous; spikelets ferruginous-brown, less than 6 mm long. .... 63. *F. spathacea*
    7. Cauline leaves, at least upper one, reduced to bladeless sheath. (Ser. *Miliaceae*).
      13. Leaves bilaterally compressed. .... 64. *F. littoralis*
      13. Leaves dorsiventrally compressed. .... 65. *F. miliacea*
  5. Stigmas 2, sometimes 3; styles more or less dorsiventrally compressed, sometimes fimbriate-margined upper; floral scales very obtuse outside without distinctly convexed keel; leaves obcompressed when 2-ranked.
    14. Style less compressed, scarcely hairy or smooth, stigmas 2 or 3.
      15. Base of culm clothed with bladeless sheath; floral scales glabrous. (Ser. *Globulosae*).  
..... 66. *F. globulosa*
      16. All cauline leaves bladeless. .... 66. *F. globulosa*



- 16. Most leaves bladed. ....67. *F. diphylloides*
- 15. Base of culms clothed with bladed leaves; floral scales ciliate. (Ser. *Leptocladae*).
  - 17. Achenes smooth, black, 1 mm long. ....68. *F. kadzusana*
  - 17. Achenes verruculose, stramineous, 0.7mm long. ....69. *F. leptoclada*
- 14. Styles strongly compressed, fimbriate above, stigmas always 2.
  - 18. Ligule of ciliate auricles or a fringe of pubescence. (Ser. *Fimbristylis*).
  - 19. Achenes smooth or verruculose, not cancellated, brown or light brown at maturity.
    - 20. Floral scales distinctly several-nerved.
      - 21. Style more than 3 mm long; anthers 1—2 mm long. ...73. *F. tristachya*
      - 21. Style less than 1.5 mm long; anthers 1/4 mm long. ...74. *F. schoenoides*
    - 20. Floral scales 1-nerved except at very base.
      - 22. Spikelet solitary terminal, rarely with 1 to 2 additions; achenes verruculose. ....70. *F. polytrichoides*
      - 22. Spikelets many, corymbose.
        - 23. Floral scales glabrous, whitish-ferrugineous; achenes verrucose. ....75. *F. Shimadana*
        - 23. Floral scales pubescent and ciliate upper; achenes smooth. ....76. *F. Sieboldii*
  - 19. Achenes distinctly scrobiculate, white-stramineous.
    - 24. Spikelets 3 to 6 mm wide. ....71. *F. dichotoma*
    - 24. Spikelets 1.5 to 2 mm wide ....72. *F. bisumbellata*
- 18. Ligule none.
  - 25. Leaves bladed; spikelets about 1.5 mm wide; small annuals. (Ser. *Squarrosae*). ....77. *F. aestivalis*
  - 25. All cauline leaves bladeless; spikelets 3—4 mm across; medium-sized plants. (Ser. *Nutantes*). ....78. *F. nutans*
- 4. Floral scales 2-ranked at least at lower part of spikelet. (Ser. *Monostachyae*).
  - 26. Achenes 2.5—3 mm long; spikelet usually solitary, terminal....79. *F. monostachyos*
  - 27. Scales glabrous. ....80. *F. Eragrostis*
  - 27. Scales pubescent.
    - 28. Scales 3 mm long; culms less than 15 cm tall.....81. *F. fimbristylis*
    - 28. Scales 4—5 mm long; culms more than 15 cm tall. ....82. *F. fusca*
- 3. Achenes oblong-cylindrical. (§ **Mischospora**).
  - 29. Spikelet solitary; styles obcompressed, fimbriate. (Ser. *Mischospora*).
    - ..... 83. *F. tetragona*
  - 29. Spikelets many, arranged in umbel-like corymb; styles slender not compressed (Ser. *Dipsaceae*).
    - 30. Scales pale-green; achenes with clavate processes. ....84. *F. dipsacea*
    - 30. Scales brownish; achenes without attachment. ....85. *F. Stauntoni*

**55. *Fimbristylis capillaris* (Linn.) A. Gray, Man. Bot. ed. 5, 567 (1872), comb. subnud, emend. hoc loco.**

*Scirpus capillaris* Linn., Sp. Pl. ed. 1, 45 (1753).—*Isolepis capillaris* (Linn.) Römer & Schultes, Syst. Veg. 2: 118 (1817).—*Bulbostylis capillaris* (Linn.) C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 651 (1893).

Distrib. North America.

The combination *F. capillaris* A. Gray was published as 'combinatio seminuda' and cited in Index Kewensis merely as *F. capillaris* A. Gray. But, Gray cited *Scirpus capillaris* Linn. as a synonym of *F. capillaris*, so that Gray's binomial was made surely with the intention of making a combination, and it should be cited as *F. capillaris* (Linn.) Gray.

var. **trifida** (Nees) T. Koyama, comb. nova.

*Isolopis densa* Römer, & Schult., Syst. Veg. Mant. 2: 71 (1817).—*Isolepis tenuissima* D. Don, Prodr. Fl. Nepal. 40 (1825).—*Scirpus densus* Wallich ex Roxburgh, Fl. Ind. ed. 2, 1: 231 (1832).—*Isolepis trifida* Nees ex Wight, Contrib. Bot. Ind. 108 (1834); Kunth, Enum. Pl. 2: 213 (1837).—*Isolopis capillaris* (Linn.) Römer & Schult. var. *trifida* (Nees) Miquel in Ann. Mus. Bot. Lugd.-Batav. 2: 75 (1865).—*F. capillaris* Hochst var. *japonica* Miquel in Ann. Mus. Bot. Lugd.-Batav. 2: 77 (1865); Franch. & Savat., Enum. Pl. Japon. 2: 120 (1877).—*Scirpus trifidus* (Nees) Hance in Journ. Bot. 16: 112 (1878).—*Bulbostylis capillaris* C. B. Clarke var. *trifida* (Nees) C. B. Clarke in Hook. f. Brit. Ind. 6: 652 (1893); Makino in Bot. Mag. Tokyo 9: 399 (1895).—*Bulbostylis densa* (Wall.) Handel-Mazzetti in Karsten & Schenk, Vegetationsb. 20 (7): 16 (1930); Ohwi, Cyper. Japon. 2, 50 (1944) & Fl. Japon 226(1953).—*Bulbostylis capillaris* C. B. Clarke var. *alpina* Honda in Bot. Mag. Tokyo 46: 5 (1932).—*Bulbostylis trifida* (Nees) Nelmes in Kew Bull. 1950: 209 (1950).

Chromosome:  $2n=84$ . Distrib.: (see the following forma). Japanese name: *Ito-hanabitsutsuki*.

forma **capitata** (Miq.) T. Koyama, stat. nov.

*Isolepis capillaris* Römer & Schult. var. *capitata* Miquel in Ann. Mus. Bot. Lugd.-Batav. 2: 75 (1855).—*Bulbostylis capillaris* C. B. Clarke var. *capitata* (Miq.) Makino in Bot. Mag. Tokyo 9: 390 (1895) & 18: 54 (1904).—*Bulbostylis japonica* C. B. Clarke (ex Matsumura, Index Pl. Japon. 2 (1): 98, 1905. nomen) in Kew Bull. Add. Ser. 8, 27 (1908).—*Stenophyllus capitatus* (Miq.) Ohwi in Mayebar, Fl. Austrohigoensis 83 (1931).—*Bulbostylis densa* Handel-Mazz. var. *capitata* (Miq.) Ohwi, Cyper. Japon. 2, 52 (1944) & Fl. Japan 226 (1953).

Japanese name: *Ito-tentsuki*. A form with sessile spikelets aggregated in a small head.

Distrib. var.: Honshu, Shikoku, Kyushu, Korea Formosa—China, India, Africa. Wet sandy soil chiefly on mountains. Common.

After carefully comparing *Bulbostylis densa* of Asia and Africa with *B. capillaris* of North America, I am unable to keep the former as specifically distinct from the latter. The difference between the two are, as already stated by Hara and other, the characters of scales and achenes, that in *B. capillaris*, scales are pubescent outside and nuts are somewhat irregularly rugulose-punctuculate, while in *B. densa*, scales are as a rule glabrous and nuts are regularly punctulate. So far as the pubescence of scales, difference is very obscure. Though typical *B. capillaris* has scales more densely pubescent and ciliate scales, in some populations of *B. densa*, scales are also distinctly ciliate and sparsely pubescent above. Only reliable character to distinguish them is, therefore, the puctuation of achenes. In my opinion, this character is not enough to make specific segregation.

The inflorescence of *B. capillaris* is a transitional state between corymb and head bearing both solitary and paired spikelets on abbreviated peduncles. That

of *B. densa* is either a loose corymb (typical form) or a head as in forma *capitata*.

**56. *Fimbristylis barbata* (Rottb.) Benth.** Fl. Austral. **7**: 321 (1878).

*Scirpus barbatus* Rottboell, Descr. & Icon. 52. t. 17 f. 4 (1773).—*Isolepis barbata* (Rottb.) R. Br., Prodr. Fl. Nov. Holl. **1**, 222 (1810).—*Isolepis Cumingii* Steudel, Synops. Pl. Glumac. **2**: 101 (1855).—*Bulbostylis barata* (Rottb.) C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 651 (1893); Chermesz. in Humbert, Fl. Madagascar 29<sup>e</sup> fam, Cypér., 196 (1837); Ohwi, Cyper. Japon. **2**, 42 (1944) & Fl. Japan (1953).

Chromosomes:  $2n=10$ .

Honshu, Shikoku, Kyushu, Ryukyus, Korea, China, India, Africa, Malaysia, Australia. Common in open, dry sandy soil in lowlands. Japanese: *Hatagaya*.

The reason why *Bulbostylis* was united to *Fimbristylis* was stated in Part 1. When *bulbostylis* is kept as a separate genus, the author name of such species as *B. barbata* or *B. capillaris*, is often attributed Kunth (Enum. Pl. **2**: 205-213. 1937). As stated by Nelmès (in Kew Bull. **1950**: 210), "Kunth, however, merely suggested that one of his sections of *Isolepis* could be regarded as a separate genus and mentioned *Bulbostylis* as a suitable name," and he did not made any legitimate combinations of these names. Therefore, the binominals *B. barbata* etc. should be attributed to C. B. Clarke (l. c. 1893).

**57. *Fimbristylis pauciflora* R. Br., Prodr. Fl. Nov. Holl. **1**, 225 (1810); Kükenth. in Mitteil. Thüring. Bot. Verhandl. N. F. **50**: 9 (1943); S. T. Blake in Journ. Arn. Arb. **35**: 210 (1954).**

*Scirpus pauciflorus* (R. Br.) Poiret, Encycl. Meth. Suppl. 98 (1817).—*Trichelostylis filiformis* Nees ex Wight, Contrib. Bot. Ind. 102 (1834).—*F. filiformis* (Nees) Kunth, Eum. Pl. **2**: 221 (1837).

Ryukyus: Is. Ishigaki, Mt. Nishiomoto. S. Hatsushima (KAG!)—Malaysia, Micronesia, Australia.

New to the Ryukyu islands.

**58. *Fimbristylis autumnalis* (Linn.) Roemer & Schultes, Syst. Veg. **2**: 97 (1817); Ohwi, Cyper. Japan **2**, 61 (1944) & Fl. Japan **229** (1953), Fernald in Gray's Man. of Bot. ed. 8, (1950).**

*Scirpus autumnalis* Linn, Mant. **2**: 180 (1771).—' *F. complanata* Link var. *microcarya* C. B. Clarke ' : C. B. Clarke in Bull. Acad. Intern. Géogr. Bot. **14**: 198 (1914); Matsumura, Index Pl. Japon. **2** (1): 291 (1905), non C. B. Clarke (1893).

Chromosomes:  $2n=10$ .

Hokkaido, Honshu, Kyushu, Korea, Ryukyus, China—North America. Wet places in lowlands. Japanese name: *Hime-tentsuki*.

var. ***microcarya*** (F. v. Mueller) Kükenth. in Engl., Bot. Jahrb. **69**: 258 (1938).

*F. microcarya* F. v. Mueller, Fragm. Phytogr. Austral. **1**: 200 (1859); Benth. Fl. Austral. **7**: 316 (1878); S. T. Blake in Univ. Queensl. Papers, Dept. Biol. **1** (3): 93 (1937) & in Journ. Arn. Arb. **35**: 216 (1954); Kern in Blumea **8**: 111 (1955).—*F. complanata* Link var. *microcarya* (F. v. Mueller) C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 646 (1893), errore *microcarpa*; Domin in Bibl. Bot. **20**, Heft. 85, 426 (1915).—*F. taiwanica* Ohwi in Journ. Jap. Bot. **14**: 574 (1838) & Cyper. Japon. **2**, 62 (1944), e typo, syn. nov.—*F. quinquangularis* Kunth forma *albudens*

Backer in Beckn. Fl. Java, em. ed., **10**, fam. 246, 26 (1949).

Formosa: Tainan. Ex Herb. T. Ito (KYO!)—type of *F. taiwanica*—India, Malaysia, Australia.

I agree with Kükenthal to treat this to be closely related to *F. autumnalis*. Although it is also undoubtedly related to *F. complanata*, it differs therefrom rather distinctly by far smaller scales and smaller achenes which have more distinct angles and less verrucose sides coloured with stramineous-creme. These floral characters, in themselves, seem to be enough to make specific distinction between *F. autumnalis* and *F. complanata*.

Var. *microcarya* differs from typical *F. autumnalis* by the smaller spikelets 2.4 mm long, 1 mm wide, smaller scales 1-1.5 mm long, and smaller achenes about 1.2 mm long.

var. **tainanensis** (Ohwi) T. Koyama, comb. nova.

*F. autumnalis* Roemer & Schult. var. *complanata* Kükenth, forma *hemisphaerica* Kükenth. in Engl., Bot. Jahrb. **59**: 6 (1924), syn. nov.—‘*F. autumnalis* Roem. & Schult. var. *complanata* Kükenth., excl. basionym.’ Kükenth. l. c. 6 (1924), non l. c. 50 (1924).—‘*F. complanata* Link’: Volkens in Engl., Bot. Jahrb. **31**: 458 (1902); Merrill in Philip. Journ. Sci. **9**: 61 (1914).—*F. tainanensis* Ohwi in Journ. Jap. Bot. **14**: 574 (1938), **18**: 133 (1942) & Cyper. Japon **2**, 63 (1944).—*F. complanata* Link var. *tainanensis* (Ohwi) Ohwi & T. Koyama in Bull. Arts & Sci. Div. Ryukyu Univ. No. 3, 71 (1959).

Formosa: Tainan Hsien, Seira in Kobigun. Y. Shimada 4456 (KYO!); Ariko, Ubon-santeimon. E. Matsuda Z-82 (TI!)—Micronesia (!).

This variety appears to be more closely related to *F. autumnalis* than to *F. complanata* by its smaller spikelets and smaller creme-coloured achenes, which agree with those of *F. autumnalis*. Because the vegetative parts, especially strongly compressed culms, are very similar to those of the southern population of *F. complanata*, I mistreated it in my previous paper (T. Koyama l. c. 1959). This variety is separable from typical *F. autumnalis* by robust habit with more conspicuous rhizomes, broader compressed culms up to 2 mm wide, broader leaves up to 3 mm wide, usually more or less capitate-contracted inflorescences, and longer anthers about 2/3 mm long.

**59. Fimbristylis complanata** (Retz.) Link, Hort. Berol. Descript. **1**: 292 (1827); Thwaites, Enum. Pl. Zeyl. 349 (1864); Suringar in Lorentz, Nova Guinea **8**: 708 (1912); Ohwi, Cyper. Japon. **2**, 63 (1944), S. T. Blake in Journ. Arn. Arb **35**: 215 (1954); Ohwi & T. Koyama in Bull. National Sci. Mus. N. S. **3**: 28 (1956); T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 44 (1957) & in Bull. Arts & Sci. Ryukyu Univ., No. 3, 69 (1959).

*Scirpus complanatus* Retz., Observ. Pt. 5, 14 (1789).—*Cyperus complanatus* (Retz.) Willd., Sp. Pl. **1**: 270 (1797).—*Isolepis complanata* (Retz.) Roem. & Schult., Syst. Veg. **2**: 119 (1817).—*Scirpus anceps* Willd. in Ges. Naturf. Fr. Berl. Magaz. **2**: 228 (1808), non Poiret (1804).—*Trichelostylis complanata* (Retz.) Nees ex Wight, Contrib. Bot. Ind. **103** (1834).—*F. autumnalis* Roem. & Schult. var. *complanata* (Retz.) Kükenth in Engl., Bot. Jahrb. **59**: 50 (1924).

Ryukyus: Is. Okinawa. S. Tawada (KYO!); Is. Iheya. S. Sakaguchi (KYO!)—Formosa:



Hsinchu Hsien, Sandan. Y. Shimada 301 (KYO!); Taipei Hsien, Kusshaku. U. Faurie 815 (KYO!); Taiton, Shinkogai Kawakami & Kobayashi 1453 b (TI!); Hwalien. Ex Herb T. Ito (KYO!)—India, China, Malaysia.

forma **exalata** T. Koyama in Bull. Arts & Sci. Div. Ryukyu Univ. No. 3, 70 (1959).

'*F. complanata* Link var. *Kraussiana* C. B. Clarke': Ohwi, Cyper. Japon. 2, 64 (1944). Chromosomes:  $2n=16$ .

Honshu (Rikuchu, Ugo and southwestwards), Shikoku, Kyushu—Ryukyus: Is. Iriomote. G. Koidzumi (KYO!)—Formosa: Hsin'kou, Y. Shimada 309 (TI!)—Korea: Zennan, Kyurei. M. K. Boku (KYO!), Keinan, Tokusan. K. Mori 48 (TI!); Goruido. T. Uchiyama (TI!); Is. Quelpaert. E. Taquet 2086 (KYO!). Open wet grassy places in lowlands and on hillsides. Japanese name: *No-tentsuki*.

The vegetative characters, especially the width of culms and leaves, tend to vary geographically to some extent, but the discontinuity is not conspicuous. The distinction between the northern variations has already been made by Ohwi (l. c.), however, because the name *F. Kraussiana*, which was accommodated to the northern population, does not represent *F. complanata* at all, a new name, forma *exalata* is necessary for the northern population. The form is differing from typical plant by wholly slenderer habit more densely tufted without distinct rhizome, more reddish-ferrugineous scales, etc.

Sometimes this species is treated as a variety of *F. autumnalis*, however, in my opinion, it is distinct from the latter by the larger achenes and scales, and more opaque surfaces of mature achenes less prominently angled than in those of the other. Also in Japan, the flower season is much earlier in *F. complanata*.

**60. *Fimbristylis Thomsonii*** Böckeler in Linnaea 37: 37 (1871); Ohwi, Cyper. Japon. 2, 65 (1944); Kern in Blumea 8: 110 (1955); T. Koyama in Contrib. Inst. Bot. Univ. Montréal, 70, 50 (1957).

Formosa—India, Burma, China, Malaysia.

**61. *Fimbristylis Pierotii*** Miquel in Ann. Mus. Bot. Lugd.-Batav. 2: 145 (1865); Ohwi, Cyper. Japon. 2, 65 (1944); Kern in Blumea 8: 112 (1955).

*F. pinetorum* Merrill in Philip. Journ. Sci. 9: 266 (1914) & Enum. Philip. Flow. Pl. 1: 125 (1923).

Honshu (Kinki & Western districts), Shikoku, Kyushu, Korea (s. part and Is. Quelpaert)—India (Himalya), N. Luzon. Japanese name: *Nohara-tentsuki*.

This is one of the most characteristic species of the genus in having long creeping stolons clothed with hard scales, which are very rare occurrence in *Fimbristylis*. I have observed such a stolon in *F. stolonifera* of China, too.

**62. *Fimbristylis sericea*** (Poiret) R. Brown, Prodr. Fl. Nov. Holl. 1, 228 (1810); Ohwi, Cyper. Japon. 2, 66 (1944) & Fl. Japon 229 (1953); T. Koyama in Contrib. Inst. Bot. Univ. Montréal, 70, 50 (1957).

*Scirpus sericeus* Poiret, Encycl. Menth. Suppl. 5: 99 (1804).—*F. decora* Nees ex Wight, Contrib. Bot. Ind. 101 (1834).—*F. velutina* Franchet in Bull. Soc. Bot. France 26: 88 (1879).

Chromosomes:  $2n=44$ .

Honshu (Noto and westwards along Japan Sea coast, Hitachi and southwestwards on Pacific side), Shikoku, Kyushu, Formosa, China, Indo-China, India, Malaysia, Austraria. In stable dune sands along sea. Japanese name: *Birodo-tentsuki*.

**63. *Fimbristylis spathacea* Roth, Nov. Sp. Pl. 24 (1821); Ohwi, Cyper. Japon. 2, 67 (1944), & Fl. Japan 229 (1953).**

*Scirpus glomeratus* Retzius, Observ. 4, 11 (1786).—*F. Wightiana* Nees ex Wight, Contrib. Bot. Ind. 99 (1834).—*F. glomerata* (Retz.) Nees in Linnaea 9: 290 (1834), comb. nud.; Kunth, Enum. Pl. 2: 246 (1837).—*F. formosensis* C. B. Clarke in Henry, List. Pl. Formos. 105 (1896), nomen.—*F. kankaoensis* Hayata, Icon. Pl. Formos. 6: 111 (1916).

Shikoku, Kyushu, Ryukyus, Formosa,—S. China, India, Malaysia. Sea shore, particularly in rocky or gravely places above the high water line. Japanese name: *Shiokaze-tentsuki*.

This is most closely allied to *F. cymosa* R. Br. of Australia. Recently, through the courtesy of Dr. H. J. Eichler, I was able to examine *F. cymosa* from Australia. The most reliable character to distinguish them is the achenes, which are almost smooth in *F. spathacea* and ragged in *F. cymosa*. The epidermal cells are regularly tetragonal in the former and transversely oblong in the latter.

var. *depauperata* T. Koyama in Journ. Jap. Bot. 30: 129 (1955).

'*F. spathacea* Roth': Ohwi, Cyper. Japon. 2, 67 (1944), ex p. quoad pl. e Kadzusa!

Honshu: Kadzusa, Ichinomiya. T. Koyama 11120 (Type in TNS!), ditto, Hitotsu-mura. I. Misono (KYO!).

It is obvious that var. *depauperata* is the northern extreme form of *F. spathacea*, but its strictly annual habit shows that this plant was already differentiated as a local variety. The warmer climate of its locality seems not to be inhibiting its perennial habit. Furthermore, such species of warmer regions as *F. longispica*, *F. Sieboldii* or *Cyperus ferax* are also growing in the same locality together with the warmer vegetation.

var. *umbellato-capitata* (Hillebr.) T. Koyama, comb. nova.

*F. cymosa* R. Br. var. *umbellato-capitata* Hillebr., Fl. Hawai. Isls. 473 (1888); Hosokawa in Trans. Nat. Hist. Soc. Formos. 25: 262 (1935).—*F. pycnocephala* Hillebr., l. c. 473 (1888); S. T. Blake in Journ. Arn. Arb. 35: 219 (1954), syn. nov.—*F. cymosa* R. Br. var. *subcapitata* C. B. Clarke ex Hemsl. in Journ. Linn. Soc. Lond. 30: 197 (1894).—'*F. cymosa* R. Br.': C. B. Clarke in Journ. Linn. Soc. 36: 232 (1803); Ohwi, Cyper. Japon. 2, 68 (1944).—*F. cymosa* R. Br. var. *microcephala* F. Brown, Fl. Southeast. Polynes. 1: 104 (1931) syn. nov.—*F. cymosa* R. Br. var. *pycnocephala* (Hillebr.) Kükenth. ex F. Br., Fl. Southeast. Polynes. 1: 104 (1931); Christophersen in Bull. Bishop. Mus. 128: 20 (1935).

Ryukus (Sakishima Isls.), Formosa—S. China, Malaysia, Pacific Islands. Sea shore.

This variety differs from typical *F. spathacea* by more or less capitate-contracted spikelets, more commonly trigynous achenes, and more grayish floral scales. It has been misidentified as *F. cymosa* by several authors.

**64. *Fimbristylis littoralis* Gaudichaud in Freycinet, Voy. Bot. 413 (1826); S. T. Blake in Journ. Arn. Arb. 35: 217 (1954).**

'*F. miliacea* Vahl, excl. basionym.': Franch. & Savat., Enum. Pl. Japon. 2: 119 (1877); C. B. Clarke in Hook. f. Fl. Brit. India 6: 644 (1893) & in Journ. Linn. Soc. 36: 239 (1903); Matsumura, Index Pl. Japon. 2 (1): 150 (1905); Matsumura & Hayata, Enum. Pl. Formosa 484

(1906); Nakai, Fl. Korean. 2: 290 (1911); E. G. Camus in Lecomte, Fl. Génér. Indochine 7: 115 (1912); Merr., Enum. Philip. Flow. Pl. 1: 124 (1922); Kitagawa, Lineam. Fl. Mansh. 118 (1939); Ohwi, Cyper, Japon. 2, 69 (1944) & Fl. Japan 230 (1935).—*Scirpus miliaceus* Linn.: Thunberg, Fl. Japon. 37 (1784).—*Scirpus tetragonus* Poir. in Lamarck, Encycl. Meth. 6: 767 (1804), non R. Br. (1810) nec Poir (1817).—*Scirpus tetragonus* Roxb., Fl. Ind. ed. 1, 1: 232 (1820), ditto ed. 2, 1: 228 (1832).—*F. tetragona* A. Dietrich, Sp. Pl. 2: 125 (1833), non R. Br. (1810).—*F. flaccidula* Zollinger, Syst. Verz. Ind. Archip. 2: 61 (1854).—*F. flaccida* Steudel, Synops. Pl. Glumac. 2: 113 (1854).—*F. quadrangularis* A. Dietrich ex Steudel, l. c. 2: 114 (1855).

Chromosomes:  $2n=10$ .

Honshu, Shikoku, Kyushu, Korea, Ryukyus, Formosa, India, Malaysia, Austraria, Micronesia, Africa. Marshy places, chiefly in rice paddy. Japanese name: *Hideriko*.

Mr. J. Léandri of Muséum national d' Histoire naturelle was kind enough to compare for me a Japanese *Fimbristylis*, commonly called *F. miliacea*, with Gaudichaud's type of *F. littoralis*, and informed me that the Japanese plant well agrees with the type. The nomenclatorial interpretation of the name *F. miliacea* is given under next species.

var. **Koidzumiana** (Ohwi) T. Koyama, stat. nov.

*F. Koidzumiana* Ohwi in Acta Phytotax. Geobot. 1: 78 (1932); T. Koyama in Bull. Arts & Sci. Div., Ryukyu Univ. No 3, 71, f. 19 (1959).

Honshu: Kadzusa, Taito-mura. M. Furuse 74 (auct. herb.!), Kii, Negoro-mura. Y. Ogawa 12 (auct. herb.!)—Ryukyus: Okinawa, Kunigami, Yona. T. Koyama 7368 (auct. herb.!), ibid. east of Taiho. T. Koyama s. n. (auct. herb.!)—Formosa; Kaoshing. U. Faurie 42 (KYO!)—Micronesia. Rice paddy.

New to Japan and Ryukyu Islands. This variety is fairly well distinguished from typical *F. littoralis* by the more ferrugineous slightly larger spikelets with larger and softer scales more or less erect at maturity, and larger, more raghned achenes. But having examined its range of variation in a good set of specimens from the Ryukyus, I became unable to keep it as a distinct species.

**65. *Fimbristylis miliacea*** (Linn.) Vahl, Enum. Pl. 2: 287 (1806); S. T. Blake in Journ. Arn. Arb. 35: 216 (1954).

*Scirpus miliaceus* Linn., Syst. Veg. 10: 868 (1759).—*Scirpus bengalensis* Pers., Synops. 1: 68 (1805).—*Scirpus quinquangularis* Vahl, Enum. Pl. 2: 279 (1806).—*Isolepis miliacea* (Linn.) Presl, Reliq. Haenk. 1: 188 (1830).—*Trichelostylis miliacea* (Linn.) Nees ex Wight, Contrib. Bot. Ind. 103 (1834) quoad basionym. tantum.—*Trichelostylis quinquangularis* (Vahl) Nees ex Wight, l. c. 104 (1834).—*Scirpus pentagonus* Roxb., Fl. Ind. ed. 1, 1: 218 (1820) & ed. 2, 1: 218 (1832).—*F. quinquangularis* (Vahl) Kunth, Enum. Pl. 2: 229 (1837); Ohwi, Cyper. Japon. 2, 70 (1944); T. Koyama in Contrib. Inst. Bot. Univ. Montréal 70, 48 (1957).—*F. Boeckeleri* Steudel, Synops. Pl. Glumac. 2: 113 (1855).—*Iriha miliacea* (Linn.) O. Kuntze, Rev. Gen. Pl. 2: 752 (1891).—*Iriha quinquangularis* (Vahl) O. Kuntze, l. c. 752 (1891).—*F. Fauriei* Ohwi in Act. Phytotax. Geobot. 1: 77 (1932).

Formosa: Tamsui U. Faurie 43 (type of *F. Fauriei* in KYO!); Taipei, Chikushiko, Y. Shimada 5088 (KYO!)—India, Indo-China, s. China, Malaysia, Australia, Africa.

The Linnaeus' specimens of *Scirpus miliaceus* Linn., on which Vahl's binomial,

*F. miliacea* was based, are a mixture of two different species, one is what we have commonly called *F. quinquangularis* and another being one commonly known as *F. milicea*. One sheet, on which Linnaeus has written as, '*miliaceus*', represents *F. quinquangularis*, and this may be accepted as the type of *S. miliaceus* (cf. C. B. Clarke in Journ. Linn. Soc. **30**: 312, 1894). For this reason, S. T. Blake (l. c. 1954) applied the name, *F. miliacea* (Linn.) Vahl to a plant, hitherto been called *F. quinquangularis* (Vahl) Kunth, then he referred the name, *F. littoralis* Gaud. to one usually called *F. miliacea*. It is true that such a change of name is undesirable (cf. Kern in Taxon **3**: 246, 1954), but to retain *F. miliacea* in the traditional sense seem to be difficult so long as we abide by the International Rules of Nomenclature so strictly.

**66. *Fimbristylis globulosa*** (Retzius) Kunth, Enum. Pl. **2**: 231 (1837); Ohwi, Cyper. Japon. **2**, 71 (1944); S. T. Blake in Journ. Arn. Arb. **35**: 215 (1954); T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 45 (1957).

*Scirpus globulosus* Retzius, Observ. pt. 5, 19 (1791).—*F. Torresiana* Gaudichaud in Freyc., Voy. Bot. **413** (1826).—*F. globulosa* Kunth var. *Torresiana* (Gandich.) C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 644 (1893).—*F. hypsocolea* Hosokawa in Trans. Nat. Hist. Soc. Formos. **28**: 152 (1938), syn. nov. e typo!—*F. globulosa* Kunth var. *austrojaponica* Ohwi, Cyper. Japon. **2**, 71 (1944).

Ryukyus (Is. Iriomote, Is. Yonaguni, Is. Ishigaki)—Indo-China, India, Ceylon, Malaysia, Micronesia.

This species is fairly variable in size of spikelets and in thickness of culms. The latter must be much influenced by the ecological conditions of the locality. Geographically this one also appears as an example of Malaysian element occurring in the southern part of the Ryukyus but not found in Formosa.

**67. *Fimbristylis diphylloides*** Makino ex Makino & Nemoto, Fl. Japan, ed. 1, 1389 (1925) cm descr. Japon.; Tuyama in Journ. Jap. Bot. **11**: 252 (1935); Ohwi, Cyper. Japon. **2**, 71 (1944) & Fl. Japan 230 (1953); Ohwi & T. Koyama in Bull. National Sci. Mus., N. S., **3**: 28 (1956).

'*F. globulosa* Kunth var. *Torresiana* C. B. Clarke': C. B. Clarke in Bull. Acad. Intern. Géogr. Bot. **14**: 199 (1904).—*F. campylophylla* Tuyama in Journ. Jap. Bot. **11**: 248 (1904), e type!—*F. campylophylla* Tuyama var. *pygmaea* Tuyama l. c. 250 (1935), e typo!—*F. diphylloides* Makino var. *campylophylla* (Tuyama) Ohwi, Cyper. Japon. **2**, 72 (1944) in descr.—*F. brevicollis* Kükenth. in Mitt. Thüring. Bot. Verhandl. N. F. **50**: 9 (1945), ex isotypo!

Chromosomes:  $2n=20$ .

Honshu (Kanto District, Is. Sado and westwards), Shikoku, Kyushu, Korea (S. part, Is. Quelpaert), Central China. Wet places in lowlands. Japanese name; *Kuro-tentsuki*.

This is also variable to some extent in size and colour of spikelets, which are usually chestnuts-brown but often reddish-brown. Being outwardly resembling *F. dichotoma*, this is quite well defined by the bladeless sheaths surrounding the base of culm, by which this is placed near *F. miliacea*. Really the digynous pistils and flat scales without convexed keel shows that the group of *F. diphylloides* and *F. globulosa* is intermediate between *Trichelostylis* and *Dichelostylis*. *F. brevicollis*



is identical with *F. diphylloides* according to Taquet, nos. 2093 and 2111 cited by Kükenthal.

**68. *Fimbristylis kadzusana*** Ohwi in Fedde, Repert. **36**: 48 (1934), Cyper. Japon. 2. 73 (1944) & Fl. Japan 230 (1934).

Honshu: Kadzusa, Takane-hongo-mura. S. Okuyama (Type in KYO!), ditto, Hitotsumatsumura. I. Misono (KYO!), ditto, Mobar. T. Koyama 5759 (auct. herb.!), ditto, Naruto. I. Tto 5450 (auct. herb.!). Peaty soil in lowlands. Japanese name: *Issun-tentsuki*.

Very local species. This seems to be quite distinct from its nearest ally, *F. leptoclada*, by its black, smooth achenes, and larger solitary spikelets with larger scales. *F. Takamineana* from the Ryukyus comes closest to this species, too. According to its holotype, the latter differs from *F. leptoclada* by the longer styles up to 1.5 mm long, and slightly larger floral scales 1.3-2 mm long, but achenes and anthers are quite similar to one another. From my experience, the length of styles varies to some extent in accordance with the length of scales even within the same species, as seen in various population of *F. dichotoma* or *F. squarrosa*. I treat *F. Takamineana* as a variety of *F. leptoclada*, because, at present, *F. Takamineana* is available only by the type collection, that is not enough to know the range of variation. However, further study may possibly prove them identical.

**69. *Fimbristylis leptoclada*** Benth. Fl. Hongk. 393 (1861); C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 647 (1893) & in Journ. Linn. Soc. **34**: 69 (1898); E. G. Camus in Lecomte, Fl. Génér. Indo-Chine **7**: 118 (1912).

*F. retusa* Thwaites, Enum. Pl. Zeyl. 349 (1864); Böckl. in Linnaea **37**: 46 (1871); Hance in Journ. Bot. **16**: 112 (1878).

Malay Peninsula, Philippines, Sumatra, Borneo.

var. ***Takamineana*** (Ohwi) T. Koyama, stat. nov.

*F. Takamineana* Ohwi in Journ. Jap. Bot. **13**: 332 (1937) & Cyper. Japon. 2, 73 (1944).

Ryukyus: Is. Ishigaki E. Takamine (Type of *F. Takamineana* in KYO!). Endemic in the Ryukyus.

For the discussion see *F. kadzusana* Ohwi.

**70. *Fimbristylis polytrichoides*** (Retz.) Vahl, Enum. Pl. **2**: 248 (1806); Nees ex Wight, Contrib. Bot. Ind. 96 (1834); Thwaites, Enum. Pl. Zeyl. 348 (1864); C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 632 (1893); Koorders, Exkursionsfl. Java **1**: 200 (1911) & **4**: 105, f. 25 (1922); E. G. Camus in Lecomte, Fl. Génér. Indo-Chine **7**: 97 (1912); Merrill, Enum. Philip. Flow. Pl. **1**: 125 (1922).

*Scirpus polytrichoides* Retzius, Observ. 5, 11 (1786).—‘*F. juncea* Römer & Schult.’: Böckl. in Linnaea **37**: 4 (1871).

Indo-malaysia.

var. ***takaoensis*** (Hayata) T. Koyama, stat. nov. e typo!

*F. Takaoensis* Hayata, Icon. Pl. Formos. **6**: 112 (1916).

Formosa: Kaoshiung. Y. Shimada s. n. (Type of *F. takaoensis* in TI!). Endemic to Formosa.

Known only by the type collection. This variety differs from typical *F. polytrichoides* by its always solitary, larger, terminal spikelets and the slightly larger nuts. Because the Hayata's type specimen is very poor unfortunately, Ohwi

misidentified *F. takaoensis* as *F. pacifica* Ohwi aff. The narrowly obovoid, light purplish-brown achenes usually with verrucosely raphened texture are quite enough to find its affinity with *F. polytrichoides*.

**71. *Fimbristylis dichotoma*** (Linn.) Vahl, Enum. Pl. **2**: 287 (1806); C. E. C. Fischer in Kew Bull. **1935**: 150 (1935); Ohwi, Cyper. Japon. **2**, 80 (1944) & Fl. Japan **231** (1953); S. T. Blake in Journ. Arn. Arb. **35**: 213 (1954); T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 39 (1957).

*Scirpus dichotomus* Linn., Sp. Pl. ed. 1, 50 (1753).—*Scirpus diphyllus* Retz., Obzerv. **5**, 15 (1789).—*F. diphylla* (Retz.) Vahl, Enum. Pl. **2**: (1806).—*F. tomentosa* Vahl, l. c. **2**: 290 (1806).—*F. communis* Kunth, Enum. Pl. **2**: 234 (1837).—*F. diphylla* Vahl var. *tomentosa* (Vahl) Benth., Fl. Hongk. **392** (1861).—*F. diphylla* Vahl var. *floribunda* Miquel in Ann. Mus. Bot. Lugd.-Batav. **2**: 144 (1865).—*F. polymorpha* Böckl. Linnaea **37**: 15 (1871).—*F. Goeringiana* Steud., Synops. Pl. Glum. **2**: 188 (1855).—*F. novae-britanniae* Böckl. in Engl., Bot. Jahrb. **5**: 93 (1884).—*F. tikushiensis* Hayata, Icon. Pl. Formos. **6**: 113 (1916).—*F. annua* Römer & Schult. var. *pseudoferruginea* Kükenth. in Bngl. Bot. Jahrb. **59**: 5 (1924).—*F. annua* Römer & Schult. var. *diphylla* (Retz.) Kükenth. (in Engl. Bot. Jahrb. **59**: 47 (1924), nomen & in Act. Hort. Gotob. **5**: (1929); C. E. C. Fischer, Fl. Presid. Madras **1658** (1931).—*F. dichotoma* Vahl var. *pallidisquama* Ohwi in Journ. Jap. Bot. **18**: 135 (1942).—*F. dichotoma* Vahl var. *disticha* T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 40 (1957), nomen in clave.

Honshu (Boso peninsula and westwards), Shikoku, Kyushu, Ryukyus, Formosa—Africa, China, India, Malaysia, N. Australia In wet open grasslands, common. Japanese name: *O-tentsuki*.

In Kew Bull. **1953**: 149-150, C. E. C. Fischer stated that the type of *Scirpus diphyllus* Retz. is identical with the type of *Scirpus dichotomus* Linn. Thus the correct name of this plant is *F. dichotoma* (Linn.) Vahl. Both *S. dichotoma* and *S. diphylla* were described from India, and they represent a very common form of this extremely polymorphous species. Because the typical *F. dichotoma*\* has relatively large spikelets solitary on the dichotomously branched secondary or tertiary branchlet, a Japanese form with clustered, slightly smaller spikelets can be separated as follows:

forma **floribunda** (Miq.) Ohwi in Journ. Jap. Bot. **14**: 577 (1938). & Cyper. Japon. **2**, 81 (1944).

*F. dichotoma* Vahl forma *tomentosa* (Vahl) Ohwi, l. c. 577 (1938) & Cyper. Japon. **2**, 81 (1944).

Honshu (Boso peninsula and westwards), Shikoku, Kyushu, Ryukyus, Formosa—S. China. Japanese name: *Kugu-tentsuki*.

The name, *F. tomentosa*, was given to a form with densely hairy leaf sheaths. In my experience, even in the extreme form of forma *floribunda*, which has quite glabrous sheaths, the orifice of sheaths and the basal part of blades are more or less hairy at least. I distinguish this form in the pairing nature of spikelets only and not the degree of hairiness.

var. **annua** (Allioni) T. Koyama, comb. nova.

\* forma **dichotoma**. = *F. dichotoma* f. *diphylla* (Retz.) Ohwi in Journ. Jap. Bot. **18**: 135 (1942).

*Scirpus annuus* Allioni, Fl. Pedemont. 2: 277, t. 88, f. 5 (1785).—*F. depauperata* R. Br., Prodr. Fl. 1, 227 (1810), non Nees (1834).—*F. annua* (Allioni) Römer & Schultes, Syst. Veg. 2: 95 (1817); S. T. Blake in Journ. Arn. Arb. 35: 212 (1954).—*Scirpus depauperatus* (R. Br.) Poiret, Encycl. Meth. Suppl. 5: 99 (1817).—*F. diphylla* Vahl var. *annua* (Allioni) & var. *depauperata* (R. Br.) C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 639 (1893).—*Scirpus ochotensis* Meish. in Act. Hort. Petrop. 18: 248 (1901).—*F. ochotensis* (Meinsh.) Komar., Fl. Penins. Kamtsch. 1: 212 (1927); Schischkin in Komar., Fl. URSS. 3: 93 (1935).—*F. annua* Römer & Schult. var. *ochotensis* (Meinsh.) Hultén, Fl. Kamtsch. 1: 170 (1927).—*F. annua* Römer & Schult. var. *pusilla* Hultén, l. c. (1927).—*F. dichotoma* Vahl forma *annua* (All.) Ohwi in Journ. Jap. Bot. 14: 577 (1938) & Cyper. Japon. 2, 81 (1944).—*F. dichotoma* Vahl var. *ochotensis* (Meinsh.) Honda in Journ. Jap. Bot. 27: 346 (1952).

Chromosomes:  $2n=20$ .

Hokkaido, Honshu, Shikoku, Korea—Manchuria, Kamtschatka, Europe, Australia, New Guinea. Grasslands. Japanese name: *Tentsuki*

Laying a stress on the constantly annual, habit, I distinguish *F. annua* as a variety of *F. dichotoma*. This view has already been proposed by S. T. Blake (in Univ. Queensl. Papers Dept. Biol. 1 (13): 2-3 (1940) & in Journ. Arn. Arb. l. c.). This annual habit is associated with the soft hairs on the upper part of culms and umbel rays also as pointed out by Blake. But in the Japanese plants, the floral scales have no such a ciliolate upper margin as observed by Blake in the plants from Australia. *F. ochotensis* is nothing else than a pygmeous form of var. *annua*. In Hokkaido, it grows around the crater of volcanoes, where the warmer condition allows to grow such a temperate plant.

var. **Tashiroana** (Ohwi) in Journ. Jap. Bot. 14: 578 (1938), Cyper. Japon. 2, 82 (1944) & Fl. Japan 231 (1953).

*F. Tashiroana* Ohwi in Bot. Mag. Tokyo 45: 377 (1931).

Kyushu (Higo, Bungo, Hyuga, Ohsumi). Endemic. Grasslands, uncommon. Japanese name: *Tsukushi-tentsuki*.

A local population in Kyushu, differing from var. *annua* by far robust habit, larger spikelets 8 to 15 mm long on well elongate peduncles, and larger obdeltoid achenes nearly truncate at the apex. A form with hairy leaves is:

forma **cincta** (Ohwi) Ohwi, Cyper. Japon. 2, 82 (1944).

*F. Tashiroana* Ohwi var. *cincta* Ohwi in Bot. Mag. Tokyo 45: 377 (1931).

Kyushu.

subsp. **longispica** (Steudel) T. Koyama, stat. nov.

*F. longispica* Steudel, Synops. Pl. Glumac. 2: 118 (1855); Ohwi, Cyper. Japon. 2, 79 (1944) & Fl. Japan 231 (1953), Ohwi & T. Koyama in Bull. National. Sci. Mus. N. S. 3: 29 (1956).—‘*F. ferruginea* Vahl’: Miquel in Ann. Mus. Bot. Lugd.-Batav. 2: 144 (1865).—*F. Buergeri* Miquel, l. c. 144. (1865).—*F. Dietrichseni* Böckl. in Engl., Bot. Jahrb. 5: 505 (1884).—*F. koreensis* C. B. Clarke ex Léveillé in Bull. Acad. Intern. Géogr. Bot. 14: 199 (1904).

Honshu (Rikuzen, Kadzusa, Sagami, Ise, Settsu), ?Shikoku, Kyushu, Korea (southern coast, Is. Quelpaert)—China (Kiangsu), India (acc. to C. B. Clarke). Marshy places particularly along sea shore, relatively local. Japanese name: *Nagobo-tentsuki*.

One would hardly realize that such a robust plant as *F. longispica* is conspecific with medium-sized *F. dichotoma*. Although in Japan and China, *F. longispica* differs from *F. dichotoma* in its larger dimension outwardly, I ascertained in the plants from the Pacific Islands that larger *F. longispica* is completely connected to small *F. dichotoma* with such intermediate plants as *F. urakasiana* and *F. hahajimensis*, as to the dimension of spikelets and leaves. The achenes and the floral scales of both plants are quite the same. Ohwi distinguished *F. longispica* from *F. dichotoma* by the more rectangular epidermal cells of achenes, lighter colour of floral scales, and perhaps by slightly longer anthers. In my observation, in *F. longispica*, leaves and bracts are constantly glabrous except at the obscurely pubescent fringe of ligule. In any way, all these characters are too trifling to make the specific segregation. In my mind, *F. longispica* is a maritime race of *F. dichotoma*, and a subspecific rank can be applied on the ecological basis.

I agree with Ohwi to treat the following Pacific plants as being more closely allied to *F. longispica* than to *F. dichotoma* proper. Though they are the intermediate between the two, longer anthers about 1 mm in length support this treatment.

var. **hahajimensis** (Tuyama) Ohwi in Journ. Jap. Bot. 18: 134 (1942), as *F. dichotoma* Vahl var.

*F. hahajimensis* Tuyama in Bot. Mag. Tokyo 49: 368 (1935)—*F. longispica* Steud. var. *hahajimensis* (Tyuyama) Ohwi, Cyper. Japon. 2, 80 (1944).

Bonin: Is. Hamajima. T. Tuyama s. n. (TI!)—Micronesia (Marian, Pagnan).

This variety differs from the following by the solitary spikelets, slenderer culms and leaves, and more densely tufted rhizome.

var. **boninensis** (Hayata) T. Koyama, comb. nova.

*F. boninensis* Hayata, Icon. Pl. Formos. 6: 109 (1916).—*F. urakasiana* Kükenth. in Engl., Bot. Jahrb. 59: 5 (1924); Hosokawa in Trans. Nat. Aist. Soc. Formosa. 25: 262 (1935)—syn. nov. *F. longispica* Steud. var. *boninensis* (Hayata) Ohwi, Cyper. Japon. 2, 80 (1944).

Bonin: Is. Chichijima. S. Nishimura (TI!, KYO!)—Micronesia (Marianne).

Differing from ssp. *longispica* by broader leaves more obtusely contracted at the apex, shorter culms, and shorter spikelets aggregated in a head. Though I have not seen the type of *F. urakasiana* Kükenth., which was described from Is. Urakas of the Marianne Islands, Hayata's Bonin plant does not differ from several Marianne plants which exactly coincide with Kükenth's original description.

**72. *Fimbristylis bisumbellata*** (Forsk.) Bubani, Dedecanth. 30 (1850); C. E. C. Fischer in Kew Bull. 1935: 145 (1935); Ohwi, Cyper. Japon. 2, 85 (1945); Kern in Blumea 8: 135 (1955).

*Scirpus bisumbellatus* Forskål, Fl. Aegypt.-Arab. 1: 15 (1775).—*F. dichotoma* Vahl, Enum. Pl. 2 287 (1806) ex pte.; C. B. Clake in Kook. f., Fl. Brit. Ind. 6: 635 (1893) & in Philip. Journ. Sci. 2: 93 (1907); Schischkin in Komar., Fl. URSS. 3: 92 (1935).—*Scirpus pallescens* Roxb., Fl. Ind. ed. 1, 1: 229 (1820).—*F. pallescens* (Roxb.) Nees ex Wight, Contrib. Bot. Ind. 101 (1834); Steud., Synops. Pl. Glumac. 2: 111 (1855).—*F. liukiensis* Tyuama in Journ. Jap. Bot. 11: 250 (1935), e type.



Ryukyus: Is Okinawa, Awase. T. Koyama s. n. (auct. herb!), Miyako. Y. Nakazone (KYO!)—Formosa. Kaoshing. U. Fausie 38 (KYO!); Bankinsing. U. Faurie 39 (KYO!)—Malaysia, India, Africa. Wet ground such as rice paddy.

This species is morphologically intermediate between *Dichotomae* and *Squarrosae*. The smaller spikelets with lighter coloured scales, smaller achenes with less fimbriate style, and slender culms and leaves suggest that this is near to *F. squarrosa* as Ohwi (l. c.) treated. The ligule of a fringe of pubescence, however, shows that this species is also related to *F. dichotoma* group.

**73. *Fimbristylis tristachya*** R. Brown, Prodr. Fl. Nov. Holl. 1, 226 (1810); T. Koyama in Bull. Art & Sci. Div., Ryukyu Univ., No. 3, 66, f. 16 F-G (1959). India, Indo-China, Malaysia, Australia, Micronesia.

var. ***subbispicata*** (Nees & Meyen) T. Koyama, stat. nov.

*F. subbispicata* Nees & Meyen in Nova Acta Nat. Cur. 19, Suppl. 1: 75 (1843): Ohwi Cyper. Japon. 2, 77 (1944) Fl. Japan 230 (1953).—‘*F. bispicata* Nees’: Nees in Hook. & Arn. Bot. Beech. Voy. 224 (1836); Böckeler in Linnaea 37: 6 (1871), ex p.—*F. japonica* Sieb. & Zucc. ex Steudel in Zollinger, Syst. Verz. Ind. Archip. 2: 62 (1854) & Synops. Pl. Glumac. 2: 107 (1855).—*F. gynophora* C. B. Clarke in Bull. Acad. Intern. Géogr. Bot 16: 60 (1906) & in Kew Bull. Add. Ser. 8, 24 (1908).—*F. crassipes* Palla in Österr. Bot. Zeitschr. 59: 192 (1909).

Chromosomes:  $2n=10$ .

Honshu, Shikoku, Kyushu, Ryukyus, Formosa, Korea, China. Abundant in wet places both in lowlands and on mountains. Japanese name: *Yamai*.

var. ***pacifica*** (Ohwi) T. Koyama, stat. nov.

‘*F. polytrichoides* Vahl’: C. B. Clarke in Bull. Acad. Intern. Géogr. Bot. 14: 199 (1904); Matumura, Index Pl. Japon. 2 (1): 151 (1905) ex p.—*F. pacifica* Ohwi in Journ. Jap. 14: 576 (1938), Cyper. Japon. 2, 78 (1944) Fl. Japan 231 (1953).

Honshu (Is. Hachijo), Shikoku, Kyushu, Ryukyu Islands. Open ground, on relatively wet soil. Japanese name: *Iso-tentsuki*, *Sugigoke-tentsuki*.

*F. tristachya*, more commonly known as *F. marianna*, is one of the widespread species of the genus in tropical Asia and Australia. It has a wide range of variation in the number of spikelets and in the size of floral scales, but is well characterized by several-nerved, more or less shining scales and stipitate achenes whitish light brown when mature. *F. subbispicata* of Japan and China, and *F. pacifica* of Japan and the Ryukyus, in my opinion, do not differ from *F. tristachya* specifically. Achenes, and venation and texture of scales are quite the same among these entities. Outwardly, *F. subbispicata* is very different from *F. tristachya* because of larger solitary terminal spikelet. However, sometimes we see an individual of *F. subbispicata* bearing more than 2 spikelets. In this case, spikelets and scales usually appears smaller. Actually only difference I can see between the two, is the difference in the size of floral scales only, that means far broader hyaline margins of the scales in *F. subbispicata*. On the one hand, *F. pacifica* agrees with *F. tristachya* in the size of scale and in every floral characters, but is different from that in smaller vegetative parts. Therefore *F. pacifica* differs from *F. subbispicata* also in smaller vegetative parts and smaller size of floral scales. During my stay in the Ryukyus, I investigated various localities of *F. pacifica*. It

is true that *F. pacifica* grows in more dry and poorer soil than *F. subbispicata* does. Presumably it would have differentiated from *F. subbispicata* owing to some edaphic factors of localities. I regard these plants as being in the varietal relations to each other.

- 74. *Fimbristylis schoenoides*** (Retzius) Vahl, Enum. Pl. **2**: 286 (1806); Ohwi, Cyper. Japon. **2**, 76 (1944); T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 44 (1957) & in Bull. Arts & Div., Ryukyu Univ., No. 3, 65 (1959).

*Scirpus schoenoides* Retzius, Observ. pt. 5, 14 (1789).—*F. kagiensis* Hayata, Icon Pl. Formos. **6**: 110 (1916), e typo!

Formosa—India, Indo-China, throughout Malaysia, Australia.

Because this species and *F. tristachya* are very similar to one another, these are sometimes regarded to be conspecific, I, however, follow an opinion that these two are respectively an independent species. The length of anthers and styles are much different as keyed above (also cf. T. Koyama, 1959).

- 75. *Fimbristylis Shimadana*** Ohwi in Acta Phytotax. Geobot. **5**: 184 (1935) & Cyper. Japon. **2**, 74 (1944).

Formosa: Kaoshiung Hsien, Daijusho. S. Ito ex herb. Y. Shimada 5474 (Type in KYO!); Tainan Hsien, Shoansekai Ex. herb. T. Ito (KYO!).

A good species distinctly separated from all closely related species of *F. ferruginea* and *F. Sieberiana* group, by the entirely glabrous floral scales.

- 76. *Fimbristylis Sieboldii*** Miquel (in Catal. Mus. Bot. Lugd.-Batav. 118 (1870), nomen) ex Franch. & Savat., Enum. Pl. Japon. **2**: 118 (1877); Makino in Bot. Mag. Tokyo **4**: 229 (1890); C. B. Clarke in Journ. Linn. Soc. **36**: 151 (1903) & in Bull. Acad. Intern. Géogr. Bot. **14**: 193 (1904); Matsumura, Index Pl. Japon. **2** (1): 151 (1905); Palla in Mond. Pl. **12**: 39 (1910); Nakai, Fl. Korean. **2**: 291 & 514 (1911); Makino & Nemoto, Fl. Japan ed. 1, 1392 (1925) & ed. 2, 1475 (1931).

*F. leiocarpa* Miquel in Ann. Mus. Bot. Lugd.-Batav. **2**: 114 (1865), non Maxim. (1860).—‘*F. subbispicata* Nees & Mey.’: C. B. Clarke in Bull. Acad. Intern. l. c. **14**: 199 (1904), quoad Faurie 4348!—*F. aginkotensis* Hayata, Icon. Pl. Formos. **6**: 108, f. 25 (1916), e typo!—*F. ferruginea* Vahl var. *Sieboldii* (Miq. ex Franch. & Sav.) Ohwi, Cyper. Japon. **2**, 75 (1944) & Fl. Japan 230 (1953).

Formosa: Is. Aginkoto. T. Kawakami 23 (Type of *F. aginkotensis* in TI!), Ryukyus, Kyushu, Shikoku, Honshu (Kadzusa and westwards along the Pacific coast, and Noto peninsula and westwards along the Japan Sea coast). Sea shore, both in sandy and rocky places. Japanese name: *Isoyama-tentsuki*.

var. ***anpinensis*** (Hayata) T. Koyama, stat. nov.

*F. anpinensis* Hayata, Icon. Pl. Formos. **6**: 108, f. 26 (1916).—‘*F. ferruginea* Vahl’: Makino in Bot. Mag. Tokyo **10**: 65 (1896); Matsumura, Index Pl. Japon. **2** (1): 194 (1905); Matsumura & Hayata, Enum. Pl. Formos. 483 (1906); Ohwi, Cyper. Japon. **2**, 74 (1944).

Ryukyus (Is. Ishigaki, Is. Iriomote, Is. Yonaguni), Formosa, Bonin Islands. Endemic. Sea shore.

Since Makino (l. c.) this species has hitherto been misidentified as *F. ferruginea* Vahl of cosmotropic distribution. *F. ferruginea*, based upon *Scirpus ferrugineus* Linn. from Jamaica, is quite different one. It has broader ovoid spikelets,

bearing ferrugineous (not fuscous, scales) and broader achenes, so that rather near to *F. Shimadana* or *F. Sieberiana*. I have examined various specimens of *F. ferruginea* from tropical Asia and Africa, and noticed the disagreements between *F. ferruginea* and *F. Sieboldii*. Further through the courtesy of Dr. S. Y. Hu of the Arnold Arboretum, I was able to examine some specimens of *F. ferruginea* from Jamaica, and confirmed my previous opinion was correct. *F. Sieboldii* has never been found in Malaysia, while *F. ferruginea* is not found in Formosa and northwards. The name, *F. Sieboldii* was validated by Franchet and Savatier, because they cited the name, *F. leiocarpa* Miq. which was properly described, as a synonym correctly.

*F. Sieboldii* of Japan is considered to be a geographical northern population of *F. anpinensis* from Formosa actually. The differences are relatively slight. *F. anpinensis*, which is here reinterpreted as var. *anpinenses*, differs from typical *F. Sieboldii* by more robust culms from more conspicuous rhizome, the leaves usually reduced to bladeless or nearly bladeless sheaths, longer cylindrical spikelets, and the anthers more than 1 mm in length.

**77. *Fimbristylis aestivalis* (Retzius) Vahl, Enum. Pl. 2: 288 (1806); F. von Mueller, Fragm. Pyltogr. Austral. 9: 11 (1875); Ohwi, Cyper. Japon. 2, 84 (1944) & Fl. Japan 232 (1953); S. T. Blake in Journ. Arn. Arb. 35: 212 (1954).**

*Scirpus aestivalis* Retzius, Observ. 4, 12 (1786).—*F. leiocarpa* Maxim. Prim. Fl. Amur. 201 (1859).—*F. tokyoensis* Makino in Bot. Mag. Tokyo 6: 47 (1892); Matsumura, Index Pl. Japon. 2 (1): 153 (1905).—*Scirpus leiocarpus* (Maxim.) Meinsh. in Act. Hort. Petropol. 18: 249 (1901).—*F. aestivalis* Vahl forma *glabra* Kükenth. in Engl., Bot. Jahrb. 57: 49 (1924).

Honshu (Mutsu, Rikuzen, Yechigo, Musahi, Ohmi), Formosa—Amurland, China, India, Malaysia, Austraria. More or less sandy wet soil, scarce. Japanese name: *Ko-azetentsuki*.

var. ***squarrosa* (Vahl) T. Koyama, stat. nov.**

*F. squarrosa* Vahl, Enum. Pl. 2: 289 (1806); F. v. Mueller, Fragm. 9: 11 (1875); Ohwi, Cyper. Japon. 2, 82 (1944) & Fl. Japan 231 (1953); Kern in Blumea 8: 143 (1955); T. Koyama in Contrib. Inst. Bot. Univ. Montréal, 70, 54 (1957).—*Scirpus squarrosus* (Vahl) Poirét, Encycl. Meth. Suppl. 5: 100 (1823), non Linn. (1757).—*Pogonostylis squarrosa* (Vahl) Bertol., Fl. Ital. 1: 312 (1833).—*F. comata* Nees ex Wight, Contrib. Bot. Ind. 99 (1834).

Chromosomes:  $2n=20$ .

Honshu, Hokkaido—Korea, China, N. Indo-China, India, N. Africa, S. Europe. Wet places especially in rice paddy, abundant. Japanese name: *Aze-tentsuki*.

var. ***esquarrosa* (Makino) T. Koyama, comb. nova.**

*F. velata* R. Brown, Prodr. Fl. Nov. Holl. 227 (1810); Kunth, Enum. Pl. 2: 243 (1837).—*F. squarrosa* Vahl var. *esquarrosa* Makino in Bot. Mag. Tokyo 17: 47 (1903); Kern in Blumea 7: 143 (1955).—*F. Makinoana* Ohwi in Journ. Jap. Bot. 14: 578 (1938) & Cyper. Japon. 2, 83 (1944).

Chromosomes:  $2n=24$ .

Honshu, Shikoku, Kyushu, Korea (s. part)—Malaysia, Australia.

F. von Mueller was the first who regarded *F. squarrosa* to be conspecific with *F. aestivalis*, then he united the latter with the former (F. v. Mueller l. c.). In outlines, I agree with him, but I propose to keep the latter as a variety of the

former. Typical *F. squarrosa* can be distinguished outwardly from *F. aestivalis* in the squarrose aspect of spikelets by the awned floral scales. However, because its variety *esquarrosa* has no squarrose spikelets, the only difference between *F. aestivalis* and *F. squarrosa* is a few, minute floral characters. In *F. squarrosa*, trichome is always present at the base of style hiding the apical part of the achene, while it is absent or very short in *F. aestivalis*. In average, floral scales and achenes are slightly longer in *F. squarrosa*, and samely, styles are a little longer in *F. squarrosa*. But, the latter characters are not absolute all the time. In var. *esquarrosa*, the trichome is also present and the size of scale and achenes match quite well to those of *F. squarrosa*, so that it is identical with it except for the shorter own of scales. I grant varietal rank for it chifly by its geographical difference. Typical *F. squarrosa* is distributed in the west of the East and South China Sea, while var. *esquarrosa* is occuring from Japan soutwards to Malaysia, partially overlapping *F. aestivalis*.

**78. *Fimbristylis nutans* (Retzius) Vahl, Enum. Pl. 2: 285 (1806); Ohwi, Cyper. Japon. 2, 86 (1944).**

*Scirpus nutans* Retzius, Observ. 4, 12 (1786).

Ryukyus (Is. Ishigaki, Is. Iriomote), Formosa—India, Indo-China, S. China, Malaysia, Australia.

**79. *Fimbristylis monostachyos* (Linn.) Hasskarl, Pl. Jav. Rar. 61 (1848); Ohwi, Cyper. Japon. 2, 58 (1944) & Fl. Japan 228 (1953); T. Koyama in Contrib. Inst. Bot. Univ. Montréal, 70, 39 (1957).**

*Cyperus monostachyos* Linn., Mant. Pl. 2: 180 (1771).—*Abidgaardia monostachyos* (Linn.) Vahl, Enum. Pl. 2: 296 (1806).

Honshu (Sagami, Kii), Kyushu, Ryukyus, Korea, Formosa.—Africa, India, S. China, Indo-China, Malaysia, Australia. In waste grassland. Japanese name: *Yari-tentsuki*.

**80. *Fimbristylis Eragrostis* (Nees) Hance in Journ. Linn. Soc. 13: 132 (1873); Ohwi, Cyper. Japon. 2, 59 (1944); S. T. Blake in Journ. Arn. Arb. 35: 215 (1954); T. Koyama in Contrib. Inst. Bot. Univ. Montréal, 70, 38 (1957).**

*Abildgaardia Eragrostis* Nees & Meyen ex Wight, Contrib. Bot. Ind. 95 (1834).

Formosa—S. China, Indo-China, Malaysia.

A very pretty species with light green leaves and dark purple spikelets. The distributional range of this species is restricted in the southeastern Asiatic Continent and Malaysia. This appears to be an example of Asia-Malaysian link as seen in several species of *Leptocladae*.

**91. *Fimbristylis fimbristyloides* (F. v. Mueller) Druce in Rep. Bot. Exch. Fl. Brit. Isls. 1916: 523 (1917); S. T. Blake in Journ. Arn. Arb. 35: 221 (1954); Kern in Blumea 8: 129 (1955).**

*Abildgaardia fimbristyloides* F. v. Mueller, Fragm. Phytogr. Austral. 8: 273 (1874).—*F. Dallachyi* F. v. Mueller ex Benth, Fl. Austral. 7: 309 (1878).—*F. lacei* Turrill in Kew Bull. 1911: 348 (1911).—‘*F. straminea* Turrill’: Ohwi in Journ. Jap. Bot. 14: 574 (1938) & Cyper. Japon. 2, 60 (1944).



Ryukyus: Is. Okinawa. S. Sakaguchi (KYO!); Is. Iriomote. S. Tawada 546 (KYO!)—Korea mt. Chiisan. M. K. Boku (KYO!)—Burma, Malaysia, Australia.

Pretty species of very rare occurrence in the Ryukyus. The locality on Okinawa Is. got lost in the war.

**82. *Fimbristylis fusca* (Nees) C. B. Clarke** in Hook f., Fl. Brit. Ind. **6**: 649 (1893); S. T. Blake in Journ. Arn. Arb. **35**: 221 (1954); Ohwi, Cyper. Japon. **2**, 50 (1944) & Fl. Japan **228** (1953); T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 39 (1957).

*Abildgaardia fusca* Nees ex Wight, Contrib. Bot. Ind. **95** (1834).—*F. fusca* (Nees) Benth in Benth. & Hook. f., Gen. Pl. **3**: 1048 (1883), nomen.—*F. stenantha* Makino ex Matsumura, Index Pl. Japon. **2** (1): 150 (1905), pro syn.

Shikoku, Kyushu—India, China, Indo-China, Malaysia. Japanese name: *Onoe-tentsuki*.

The combination, *F. fusca* (Nees), sometimes attributed to Benth, however, because his combination is a nomen nudum, I cite it as *F. fusca* (Nees) C. B. Clarke.

**83. *Fimbristylis tetragona* R. Brown**, Prodr. Fl. Nov. Holl. **1**, 226 (1810); C. B. Clarke, Illustr. Cyper. t. 40, f. 1-4 (1909); Kükenth. in Mitteil. Thüring. Bot. Verh. N. F. **50**: 8 (1943); Ohwi, Cyper. Japon. **2**, 56 (1944); S. T. Blake in Journ. Arn. Arb. **35**: 208 (1954).

*Scirpus tetragonus* (R. Br.) Poir., Encycl. Meth., Suppl. **5**: 98 (1817), non Poir. (1817).—*E. cylindrocarpa* Kunth, Enum. Pl. **2**: 222 (1837).—*F. objiciens* Steudel, Synops. Pl. Glumac. **2**, 107 (1855).—*Mischospora efoliata* Böckeler in Flora **43**: 113 (1860).—*F. Arnottii* Thwaites, Enum. Pl. Zeyl. **348** (1864).—*F. xyroides* Arnott ex Thwaites, Enum. Pl. Zeyl. **348** (1864), pro syn.

Formosa: Hsinchu Hsien, Chureki. Y. Shimada 2669 (KYO!) India, S. China, Malaysia, Australia.

**84. *Fimbristylis dipsacea* (Rottb.) C. B. Clarke** in Hook. f., Brit. Ind., **6**: 635 (1895).

*Scirpus dipsaceus* Rottboell, Descr. & Icon. **56**, t. 12 f. 1 (1773).—*Echinolytrum dipsaceum* (Rottb.) Desv. in Journ. Bot. **1**: 21, t. 1 (1808).—*Isolepis dipsaceus* (Rottb.) Roem. & Schult., Syst. Veg. **2**: 119 (1811).

var. ***verrucifera* (Maxim.) T. Koyama**, stat. nov.

*Isolepis verrucifera* Maxim., Prim. Fl. Amurens. **300** (1859).—*F. nipponensis* Makino in Bot. Mag. Tokyo **6**: 47 (1892), nomen nudum.—*Scirpus verruciferus* (Maxim.) Meinsh. in Acta Hort. Petropol. **18**: 246 (1901).—‘*F. dipsacea* C. B. Clarke’: Komarov, Fl. Mansh. **1**: 346 (1901); C. B. Clarke in Bull. Acad. Intern. Géogr. Bot. **14**: 199 (1904).—*Echinolytrum verruciferum* (Maxim.) Makino in Bot. Mag. Tokyo **20**: 9 (1906).

Honshu, Shikoku, Korea, Manchuria, Ussuri. Wet places in lowlands, uncommon. Japanese name: *Ao-tentsuki*.

Having examined several specimens of *F. dipsacea* from India and Malaysia, I am unable to separate Far Eastern *F. verrucifera* specifically from it. The achenes are same in both species. Only differences between the two are globose and more numerous spikelets of *F. verrucifera* and longer excurrent awn of scales in *F. dipsacea*, which makes the squarrose aspect of spikelets. As for the latter character even if in *F. verrucifera*, at least several scales in the lower part of

spikelets have long excurrent awn-like tip as in those of *F. dipsacea*, but because the spikelets bear more numerous flowers quite tightly, the squarrose aspect is not so conspicuous as in *F. dipsacea*. I believe that *F. verrucifera* is a local population of southern Asiatic *F. dipsacea*.

85. **Fimbristylis Stauntoni** Debeaux & Franchet ex Debeaux in Act. Linn. Soc. Bord. (31: t. 3. 1877, &) 32: 38 (1878); Ohwi, Cyper. Japon. 2, 57 (1944) & Fl. Japan 228 (1953); Ohwi & T. Koyama in Bull. National Sci. Mus. N. S. 3: 29 (1956).

'*F. tonensis* Makino': Palla in Mond. Plant. 12: 40 (1910).

Kyushu: Hizen, Sugitani-mura. S. Hatsusima (KYO!); Higo, Onoshita. T. Sugino 120 (TI!)—Korea: Kannan, Unnammen. N. Nomura (KYO!)—Central China. Japanese name: *Hatake-tentsuki*.

var. **tonensis** (Makino) Ohwi, Cyper. Japon. 2, 58 (1944), pro syn., & Fl. Japan 228 (1953), nom., emend. hoc loco.

*F. tonensis* Makino in Bot. Mag. Tokyo (9: 260. 1895. nomen seminud. &) 17: 45 (1903); Ohwi, Cyper. Japon. 2, 58 (1944).

Honshu: Kadzusa, Torami. T. Koyama. TSM. 1086 (TI!); Kadzusa, Cape Daito. M. Furuse (auct. herb.!). Tokyo, Koiwa. T. Koyama 180 (Type of *F. tonensis* in TI!); Settsu, Kumanodamura. N. Ui (TI!). Japanese name: *Tone-tentsuki*.

I am sure that *F. tonensis* is conspecific with *F. Stauntoni* of Central China. The only difference between the two is the longer styles and stigmas of var. *tonensis*, which make the comose look of the spikelets. This difference of stigmas and styles is very clear geographically. No specimen of var. *tonensis* with long stigmas has been found in the Western district of Honshu and westwards, where short-stigmatic *F. Stauntoni* appears in turn. In this geographical significance of stigmas and styles, I granted varietal status for eastern Japanese var. *tonensis*.

#### PROBABLE NATURAL HYBRID

- (9) **Fimbristylis × Itaru-Itoana** T. Koyama in Journ. Jap. Bot. 30: 130 (1955).  
*F. autumnalis* Roem. & Schult. × *F. Stauntoni* var. *tonensis* Ohwi.  
Honshu (Kadzusa).

#### Genus 5. CYPERUS Linn.

Owing to the space considerations, the revision of the species of the genus *Cyperus* in eastern Asia will be published separately in the Quarterly Journal of the Taiwan Museum, Vol. 14 (1961). The fifty species to be enumerated here are numbered as follows:

##### Subgen. I. CYPERUS.

##### § 1. **Cyperus.**

86. *C. digitatus* Roxb.

87. *C. Ohwii* Kükenth.

88. *C. imbricatus* Retz.

88-b. var. *multiflorus* Kükenth.

89. *C. exaltatus* Retzius

var. *Iwasakii* (Makino) T. Koyama

90. *C. Papyrus* Linn.

91. *C. textilis* Thunb.

92. *C. nultans* Vahl

var. **subprolixus** (Kükenth.)

T. Koyama, comb. nova.

93. *C. glomeratus* Linn.

94. *C. distans* Linn. fil.  
 95. *C. tenuiculmis* Böcklr.  
 96. *C. stoloniferus* Retzius  
 97. *C. rotundus* Linn.  
 98. *C. tuberosus* Rottb.  
 99. *C. malaccensis* Lamarck  
 99-b. var. *brevifolius* Böcklr.  
 100. *C. procerus* Rottb.  
 101. *C. pilosus* Vahl  
 102. *C. orthostachys* Fr. & Sav.  
 103. *C. iria* Linn.  
 104. *C. microiria* Steudel.  
 105. *C. amuricus* Maxim.  
 106. *C. compressus* Linn.  
 107. *C. difformis* Linn.  
 108. *C. prolifer* Lamarck  
 109. *C. haspan* Linn.  
 109-b. var. *tuberiferus* T. Koyama  
 110. *C. tenuispica* Steudel  
 111. *C. flaccidus* R. Br.  
 112. *C. cuspidatus* H. B. K.  
 113. *C. platystylis* R. Brown  
 114. *C. alternifolius* Linn.  
     var. *obtusangulus* (Böcklr.)  
     T. Koyama, comb. nova  
 115. *C. Eragrostis* Lamarck  
 116. *C. diffusus* Vahl  
 117. *C. radians* Nees & Meyen  
     § 2. **Juncellus** Griseb.  
 118. *C. serotinus* Rottb.  
     § 3. **Dichostylis** Baill.  
 119. *C. limosus* Maxim.  
 119-b. var. **spiralis** (Ohwi) T. Koyama,  
     comb. nova  
 119-c. var. **niigatensis** (Ohwi) T. Koyama,  
     stat. novus
120. *C. Michelianus* Link  
     var. *pacificus* Ohwi  
 120-b. subsp. *pygmaeus* Aschers. & Graebn.  
     Subgen. II. **PYCREUS** C. B. Clarke  
 121. *C. latespicatus* Böcklr.  
     var. *setiformis* T. Koyama  
 122. *C. sanguinolentus* Vahl  
 122-b. var. *spectabilis* Makino  
 123. *C. unioloides* R. Brown  
 124. *C. globosus* All.  
 125. *C. polystachyos* Rottb.  
 126. *C. pumilus* Vahl  
     Subgen. III. **MARISCUS** C. B. Clarke  
     § 1. **Mariscus**.  
 127. *C. cyperoides* O. Kuntze  
 127-b. var. **boninensis** (Ohwi) T. Koyama,  
     stat. novus  
 128. *C. cyperinus* Suringar  
 129. *C. compactus* Retzius  
 130. *C. javanicus* Houttuyn  
     § 2. **Diclidium** Benth. & Hook. f.  
 131. *C. ferax* L. C. Rich.  
     § 3. **Remirea** (Aublet) T. Koyama,  
     stat. nov.  
 132. *C. pedunculatus* Kern  
     Subgen. IV. **KYLLINGA** Suringar  
 133. *C. brevifolius* Hasskarl  
 133-b. var. *leiolepis* T. Koyama  
 134. *C. Kernianus* Ohwi & T. Koyama  
 135. *C. Kyllingia* Endlicher  
     Subgen. V. **LIPOCARPHA** (R. Br.)  
     T. Koyama, stat. nov.  
 136. *C. Zollingeriana* T. Koyama  
 137. *C. Lipocarpa* T. Koyama

# Genus 6. *CLADIUM* P. Browne ex Crantz.

The genus *Cladium* in a wide meaning is morphologically heterogenous to a considerable extent. Chiefly basing upon the unique shape of the pollen grains and their associated characters observed in *Cladium rubiginosum* Domin and its close allies, I proposed to divide *Cladium* sensu lato into two genera, *Cladium* sensu str. and *Machaerina*. This proposal has been accepted by several specialists who are interested in the Cyperaceae of Malaysia and of Australia. The genus *Cladium* in its original sense, which was based upon only one species, *Cladium jamaicense* Crantz, is characterized by the dorsiventral nature of leaves and bracts,

drupe-like achenes without any persistent style-base, and corymbose partial inflorescences with concave centre. So that it is quite different from such groups as *Machaerina*, *Baumea* and *Vincentia*, which have the leaves and bracts, of unifacial nature, hard achenes crowned by the beak-shaped persistent base of styles, and paniculate partial inflorescences convexed at the apex. All of these latter groups are united into one genus, of which the correct name is *Machaerina*. An interesting matter is that a very unique shape of the pollen grains, which is called the polyphorate type, has been found in *Machaerina rubiginosa*. It is possible that this type of pollen grains also occur in the genus *Lepidosperma*, the close ally of the genus *Machaerina*.

The genus *Cladium* in its original sense is represented in Japan only by one species, *Cladium jamaicense* Crantz.

**138. *Cladium jamaicense*** Crantz, Instit. 1: 362 (1766); C. B. Clarke in Dur. & Schinz, Consp. Fl. Afric. 5: 665 (1895), in Urban, Symb. Antill. 2 (1): 134 (1900), & in Thiseit. Dyer, Fl. Trop. Afr. 8: 484 (1902); Schönland in Bot. Surv. Afr. Mem. 3: 62, t. 71 (1922); Kükenth. in Fedde, Repert. 51: 189 (1942).

*Echoenus elevatus* Soland., ex Forst. f., Fl. Ins. Austr. Prodr. 89 (1786).—*Schoenus Cladium* Swartz, Prodr. 19 (1788).—*Cl. occidentale* Schrader, Fl. Germ. 1: 76 (1806).—*Cl. leptostachyum* Nees (in Linnaea 9: 301 (1835), nomen) ex Nees & Meyen in Nov. Act. Acad. Nat. Curios 19, Suppl. 1: 115 (1843); Hillebr., Fl. Hawaii. Isls. 478 (1888).—*Cl. bahiense* Nees (l. c. 301. nomen) ex Steudel, Synops. Pl. Glum. 2: 152 (1855).—*Mariscus jamaicensis* (Crantz) E. Janchen ex Schinz & Thellung, Virterjahrsschr. Nat. Gesel. Zürich 53: 524 (1908), pro syn.; Britton & Brown, Illustr. Fl. North. U. S. 1: 348, f. 858 (1913).

Tropical and warm regions of N. & S. America and Africa, also in the Hawaiian islands.

var. **chinense** (Nees) T. Koyama, stat. nov.

*Cl. chinense* Nees (in Linnaea 9: 301 (1934), nomen) ex Hook. & Arn., Bot. Beech. Voy. 227. (1841); Nees in Nov. Act. Acad. Nat. Curios 19, Suppl. 1, 116 (1843); Steud., Synops. Pl. Glumac. 2: 152 (1855); Franchet & Savat., Enum. Pl. Japon. 2: 121 (1877); Handel-Mazzetti, Simb. Sin. 7, 1253 (1936); Ohwi, Cyper. Japon. 2, 10 (1944) & Fl. Japan 218 (1953).—*Cl. japonicum* Steudel, Synops. Pl. Glum. 2: 152 (1855).—‘*Cl. Mariscus* R. Br.’: Bockeler in Linnaea 38: 232 (1874), pro pte.; Palla in Mond. Pl. II-12: 39 (1910); Nakai, Fl. Korean. 2: 513 (1911).—‘*Cl. jamaicense* Crantz’: C. B. Clarke in Journ. Linn. Soc. 36: 262 (1903); Matsumura, Index Pl. Japon. 2 (1): 139 (1905); Hayata, Icon. Pl. Formos. 6: 117 (1916).—*Mariscus chinensis* (Nees) Fernald in Rhodora 25: 51 (1923).

Honshu (Boso peninsula and westwards in the Pacific side, Noto peninsula and westwards in the Japan Sea side), Shikoku, Kyushu, Korea (Is. Quelpaert), Ryukyus, Formosa—S. China. Relatively wet, sunny places chiefly near, the sea coast. Japanese name: *Hitomoto-susuki*, *Shishikirigaya*.

As already stated by Ohwi (l. c. 1944), the Japanese plants differ from the European *Cl. Mariscus* both in the vegetative and the achene characters. The relationship between this and the *Cl. jamaicense* of central America has been variously explained by several specialists concerned. Franchet, Handel-Mazzetti and Ohwi are of opinion that the Japanese plants are specifically distinct from typical *Cl. jamaicense*, while Kükenth. and C. B. Clarke considered the two to be identi-



cal. Last summer I have seen many specimens of *Cl. jamaicense* from southern United States and Jamaica Is., and found that the two are not quite the same, but the difference is only the shape and size of achenes. The plants from Japan and its neighbouring regions have slightly larger, ovoid-elliptic achenes 2.5 mm long, while in the plants from America, the smaller achenes are broadly ovoid and about 2 mm in length. It is of interest that *Cl. jamaicense* sensu str. does not occur in Malaysia, though it is widely spread in the tropics of both America and Africa. The plants from Japan would have been differentiated from the Americo-Hawaiian population. I treat *Cl. chinense* of Japan and China as a variety under *Cl. jamaicense*, an Americo-African element.

Genus 7. *MACHAERINA* Vahl emend. T. Koyama.

The circumscription of the genus *Machaerina* here adopted was mentioned under the previous genus. Mainly on the basis of the achene characters, the genus can be subdivided into two sections, *Machaerina* and *Baumea*. The section *Machaerina* is characterized by the very sharp angles, sometimes tending to be wing-like, and usually open partial inflorescences. In the section *Baumea*, the achenes are almost globular without any distinct angles and with a rounded base. The partial inflorescences of *Baumea* are more often aggregated in head like partial clusters of spikelets. Thus the group *Vincentia* should belong to *Machaerina*, while the group *Chapelliera* is consectional with *Baumea*. All the species known from Japan and its surrounding regions belong to the section *Baumea*.

Section **Baumea** (Gaudich.) Benth., Fl. Austral. 7: 401 (1878); T. Koyama in Bot. Mag. Tokyo 69: 62 (1956).

Gen. *Baumea* Gaudich. in Freyc., Voy. Bot. 416, t. 29 (1826)—Gen. *Chapelliera* Nees in Linnaea 8: 298 (1834).

Ser. a) **Baumea**.

*Cladium* sect. *Ancipita* Kükenth. in Fedde, Repert. 51: 149 (1942).

Type: *Baumea glomerata* Gaudich. (= *Machaerina glomerata* (Gaud.) T. Koyama).

Ser. b) **Obtusangula** (Kükenth.) T. Koyama, stat. nov.

*Cladium* subgen. *Baumea* sect. *Obtusangula* Kükenth. in Fedde, Repert. 51: 160 (1942).

Type: *Machaerina rubiginosa* T. Koyama (Lectotype).

1. Leaves terete; stylebase depressed-conical. (Ser. *Obtusangula*). .....139. *M. rubiginosa*
1. Leaves bilaterally compressed; stylebase beak-like. (Ser. *Baumea*).
2. Spikelets aggregated in glomerules. ....140. *M. glomerata*
2. Spikelets scarcely paired, scattered in open panicles.....141. *M. sucinonux*

**139. *Machaerina rubiginosa*** (Sprengel) T. Koyama in Bot. Mag. Tokyo 69: 65 (1956), emend.

*Schoenus rubiginosus* Solander ex Forst., Prodr. 89 (1786), nomen.—*Fuirena rubiginosa* Sprengel, Fl. Halensis Mant. 1: 29 (1807), cum descr.!—*Cladium glomerata* R. Br., Prodr. Fl. Nov. Holl. 1, 237 (1810); Kunth, Enum. Pl. 2: 304 (1837); Steud., Synops. Pl. Gl. 2, 152 (1855); F. v. Mueller, Fragm. Phytogr. Austral. 9: 15 (1875); Benth., Fl. Austral. 7: 404 (1878); Bailey, Queensl. Fl. 6: 1792 (1902); Cheeseman, Man. N. Zeal. Fl. 786 (1906); Black, Fl. South Austr. 1: 95 (1922) [non *Baumea glomerata* Gaudich. (1826).]—*Cladium dubium* Nees ex

Sprengel, Syst. Cur. Post. 71 (1827).—*Chapelliera glomerata* (R. Br.) Nees in Lehmann. Pl. Preiss. 2: 76 (1847), in observ.—*Baumea rubiginosa* (Spreng.) Böcklr. in Linnæa 38: 241 (1874) & in Flora 58: 116 (1875).—*Baumea Brownei* Böcklr. in Linnæa 38: 242 (1874).—*Gahnia glomerata* (R. Br.) F. v. Mueller, Key Vict. Pl. 1: 455 (1888).—*Mariscus glomeratus* (R. Br.) O. Kuntze, Rev. Gen. Pl. 2: 755 (1891).—*Cladium rubiginosum* (Spreng.) Domin in Biblioth. Bot. 20, Heft 85, 476 (1915); Black, Fl. South Austral. 4: 678 (1929); Kükenth. in Fedde, Repert. 51: 171 (1942).—*Cladium brevistigma* Nakai ex Tuyama in Bot. Mag. Tokyo 49: 509 (1935); Ohwi, Cyper. Japon. 2, 12 (1944).—*Machaerina brevistigma* (Nakai ex Tuyama) T. Koyama in Bot. Mag. Tokyo 69: 63 (1956).

Bonin Islands: Without definite locality. H. Hattori s. n. (Type of *Cl. brevistigma* in TI!); ibid. T. Tuyama (TI!)—Malaysia, Australia.

I have not seen the mature fruit of *Cladium brevistigma* Nakai of the Bonin Islands, but it quite well agrees with *Cladium rubiginosum* (= *Mach. rubiginosa*) from Australia in every respect. The combination, *Mach. rubiginosa*, should ultimately depend on *Fuirena rubiginosa* Spreng. which was properly described, because the name *Schoenus rubiginosus* Solander is a 'nomen nudum'.

A similar Japanese plant, called *Cladium nipponense*, is separable from *Mach. rubiginosa* only in the slightly longer spikelets bearing 5 to 7 flowers, and more or less longer styles. I, therefore, treat this a variety of widespread *Mach. rubiginosa* as follows. Being unable to see the specimen related, I am not sure if the Chinese plant determined by Kükenth. as *Cl. rubiginosum* belongs to this variety.

var. **nipponensis** (Ohwi) T. Koyama, stat. nov.

'*Cladium glomeratum* R. Br.': C. B. Clarke ex Léveillé in Bull. Acad. Intern. Géogr. Bot. 14: 200 (1904); Matsumura, Index Pl. Japon. 2 (1): 139 (1905).—'*Chapelliera glomerata* Nees': Franch. & Savat., Enum. Pl. Japon. 2: 121 (1877).—'*Baumea Brownei* Böcklr.': Franch. & Savat., Enum. Pl. Japon. 2: 548 (1879).—*Cladium nipponense* Ohwi, Cyper. Japon. 2, 11 (1944) & Fl. Japan 219 (1953).—'*Cladium rubiginosum* Domin': Kükenth. in Fedde, Report. 51: 171 (1941), saltem quoad pl. e Japonia! —*Mach. nipponensis* (Ohwi) Ohwi & T. Koyama in Bot. Mag. Tokyo 69: 65 (1956).

Honshu (Tokai district, Kii peninsula, western district), Shikoku, Kyushu, Ryukyus. Open marshy places, usually as a pure colony. Japanese name: *Nebiki-gusa*, *Ampera-i*.

**140. *Machaerina glomerata*** (Gaudich.) T. Koyama in Bot. Mag. Tokyo 69: 63 (1956).

*Baumea glomerata* Gaudichaud in Freyc., Voy. Bot. 46, t. 29 (1826).—*Cladium globiceps* C. B. Clarke in Kew Bull. Add. Ser. 8, 46 (1908); Kükenth. in Fedde, Report. 51: 154 (1942).—*Cladium boninsimae* Nakai in Bot. Mag. Tokyo 25: 223 (1911); Ohwi, Cyper. Japon. 2, 12 (1944), syn. nov. e typo!—*Cladium glomeratum* (Gaudich.) H. Pfeiffer in Fedde, Repert. 23: 349 (1927), [non R. Br. (1810)]—*Mariscus globiceps* (C. B. Clarke) Fernald in Rhodora 25: 53 (1932).—*Cladium globiceps* C. B. Clarke var. *boninsimae* (Nakai) Kükenth. in Fedde, Repert. 51: 155 (1942).—*Machaerina boninsimae* (Nakai) T. Koyama in Bot. Mag. Tokyo 69: 62 (1956).

Bonin Islands: Without definite locality. S. Nishimura 91 (Type of *Cl. boninsimae* Nakai in TI!); Is. Chichijima. T. Tuyama s. n. (TI!)—Molucca Islands.

The type and authentic materials of *Cladium boninsimae* Nakai, which have some perfect mature fruits, exactly coincides with *Cladium globiceps* of the Moluccas. Kükenth. separated *Cl. boninsimae* from *Cl. globiceps* as a variety stating that

the Bonin plants have larger achenes 3.5 mm in length. But, in my observation, the achenes of *Cl. boninsimae* are about 2.5 mm long and not 3.5 mm as measured by Kükenthal. Though *Cl. globiceps* has been once treated as a variety of *Cl. colpodes* of Malaysia and Micronesia, it is quite distinct from the latter at least in far larger floral scales and more nitidous surface of achenes. Furthermore, in my opinion, *Cl. colpodes* is not specifically distinct from the well-known *Cl. Gaudichaudii* W. F. Wight. (= *Machaerina mariscoides* Kern).

**141. *Machaerina sucinonux*** T. Koyama in Bot. Mag. Tokyo **69**: 66 (1956).

Bonin Islands: Is. Hahajima. K. Sawatari 86 (Type in TI!). Endemic to Bonin Islands.

This poorly collected species differs from its nearest ally, *Mach. Meyenii* of Hawaii, in its smaller achenes 2-2.2 mm long (3-4 mm in *Mach. Meyenii*) and looser panicles.

Genus 8. **GAHNIA** Forst.

Two species are represented in Japan. Both of them belong to the following section.

Section **Inclusae** Kükenth. in Fedde, Repert. **52**: 84 (1943).

Type: *Gahnia aspera* (R. Br.) Sprengel.

1. Achenes broadly ellipsoid, 5—5.6 mm long; floral scales suddenly acute at apex; inflorescence dense .....142. *G. aspera*
1. Achenes obovoid, trigonous, 4—4.5 mm long; floral scales gradually narrowed at apex; inflorescence interrupted at least at base. ....143. *G. tristis*

**142. *Gahnia aspera*** (R. Br.) Sprengel, Syst. Veg. **2**: 114 (1825); F. v. Mueller, Pap., Pl. **2**: 69 (1890); Kükenth. in Fedde, Repert. **52**: 92 (1943); Ohwi, Cyper. Japon. **2**, 13 (1944); S. T. Blake in Journ. Arn. Arb. **29**: 99 (1948).

*Lampocarya aspera* R. Brown, Prodr. Fl. Nov. Holl. **1**, 238 (1810).—*Cladium asperum* (R. Br.) F. v. Mueller, Fragm. Phytogr. Austral. **9**: 12 & 56 (1875).—*Hexalepis scabrifolia* Böckl. in Flora **58**: 118 (1875).—*Mariscus aspera* (R. Br.) O. Kuntze, Rev. Gen. Pl. **2**: 755 (1891).—*G. boninsimae* Maxim. in Mém. Biol. **12**: 559 (1886).

Bonin Islands: without definite locality. J. Toyoshima. (KYO!)—Malaysia, Polynesia, Australia.

**143. *Gahnia tristis*** Nees (in Linnaea **9**: 301. 1834. nomen nud.) ex Hook. & Arn., Bot. Beech. Voy. **228** (1841); Kükenth. in Fedde, Repert. **52**: 96 (1943); Ohwi, Cyper. Japon. **2**, 14 (1944); T. Koyama in Contrib. Inst. Bot. Univ. Montréal. **70**, 51 (1957).

*G. Wichurai* Böckl. in Linnaea **38**: 348 (1874).—*G. Boniana* Böckl. in Allg. Bot. Zeitschr. **2**: 141 (1896); E. G. Camus in Lecomte, Fl. Génér. Indo-Chine **7**: 154 (1912).—*G. stricta* Böckl. in Allg. Bot. Zeitschr. **2**: 142 (1896).

Ryukyus: (Amami-Oshima Is., Tokunoshima Is., Okierabu Is., Okinawa Is.)—Malaysia, Indo-China. Occasional on exposed open slope.

Genus 9. **SCHOENUS** Linn.

Among some 85 species, the genus is represented by only 4 in Japan including

the Ryukyus and Bonin islands. They belong to a separate series each.

Series 1. **Lepidospora** (F. v. Mueller) T. Koyama, stat. nov.

Gen. *Lepidospora* F. v. Mueller, Fragm. Phytogr. Austral. **9**: 34 (1875) in annotatione; Moore & Betche, Handb. Fl. N. South-Wales 445 (1893)—Sect. *Calostachyi* Benth., Fl. Austral. **7**: 355 (1878), ut *Calostachyae*—Subgen. *Lepidospora* (F. v. Muell.) C. B. Clarke in Kew Bull. Add. **8**, 123 (1908).

Type: *Lepidospora tenuissima* (Hook. f.) F. v. Muell. (= *Sch. tenuissimus* (Hook. f.) Benth.).

Series 2. **Paniculatae** (Benth.) T. Koyama, stat. nov.

Sect. *Paniculatae* Benth., Fl. Austral. **7**: 355 (1878); C. B. Clarke in Kew Bull. Add. Ser. **8**, 123 (1908), pro maiore parte—Sect. *Longisetes* Kükenth. in Fedde, Repert. **44**: 17 (1938)—Sect. *Scrobiculati* Kükenth. in Fedde, Repert. **44**: 22 (1938).

I typify *Paniculatae* with *Sch. falcatus* R. Br., which was cited by Benth. under his *Paniculatae* and is one of the most well known species of the genus. The name *Paniculatae* is based upon neither *Sch. paniculatus* (= *Gahnia javanica*) nor *Chaetospira paniculata* (= *Carpha* sp.), so I cite it as *Paniculatae*.

Series 3. **Nudicaules** (Kükenth.) T. Koyama, stat. nov.

Sect. *Nudicaules* Kükenth. in Fedde, Repert. **44**: 26 (1938)—Sect. *Paniculatae* Benth., l. c., pro pte.

Type: *Schoenus brevifolius* R. Br. (Lectotype).

Series 4. **Heleothesis** (Nees) T. Koyama, stat. nov.

Gen. *Heleothesis* Nees in Ann. Nat. Hist. Sper. **1**, **6**: 45 (1841)—Sect. *Microcarpae* Benth. Fl. Austral. **7**: 356 (1878)—*Microcarpae* C. B. Clarke in Kew Bull. Add. Ser. **8**, (1908)—Sect. *Heleothesis* (Nees) Kükenth. in Fedde, Repert. **44**: 84 (1938).

Type: *Heleothesis pusilla* Nees (= *Sch. subaxillaris* Kükenth.).

1. Spikelets distinctly peduncled, solitary; robust plants more than 5 dm tall.
2. Spikelets 2—2.5 cm long, few, very loose. (Ser. *Lepidosperma*). .....144. *Sch. calostachyus*
2. Spikelets 8 to 13 mm long, many, subdense to subslax.
3. Leaves long-bladed. (Ser. *Paniculatae*) .....145. *Sch. falcatus*
3. All leaves reduced to bladeless sheaths. (Ser. *Nudicaules*) .....146. *Sch. brevifolius*
1. Spikelets almost sessile, clustered in 2 to 5; slender annual less than 2 dm tall. (Ser. *Heleothesis*) .....147. *S. apogon*

**144. *Schoenus calostachyus*** (R. Br.) Poir., Encycl. Meth. Suppl. **2**: 251 (1811); F. v. Mueller, Pap. Pl. **2**: 69 (1890); Bailey, Queensl. Fl. **6**: 1785 (1902); Surin-gar in Lorentz, Nova Guinea, Bot., **8**: 787 (1912); Domin in Bibl. Bot. **20**, Heft. 85, 471 (1915); Kükenth. in Engl., Bot. Jahrb. **59**: 7 (1924) & in Fedde, Repert. **44**: 73 (1938); Ridley, Fl. Malay. Penins. **5**: 166 (1925); Ohwi, Cyper. Japon. **2**, 26 (1944); S. T. Blake in Journ. Arn. Arb. **29**: 91 (1948).

*Chaetospira calostachya* R. Br., Prodr. Fl. Nov. Holl. **1**, 233 (1810); Steudel, Synops. **2**: 162 (1855).—*Cyclocampe waigionensis* Steudel, l. c. 156 (1855).—*Cyclocarpa waigionensis* (Steud.) Miquel, Fl. Ind. Batav. **3**: 339 (1859).—*Sch. triangularis* Volkens in Engl., Bot. Jahrb. **31**: 458 (1902).

Ryukyus (Is. Iheyajima)—Malaysia, Australia, Micronesia.

**145. *Schoenus falcatus*** R. Brown, Prodr. Fl. Nov. Holl. **1**, 232 (1810); Steud., Synops. Pl. Glumac. **2**: 165 (1855); F. v. Mueller, Fragm. Phytogr. Austral. **9**: 29 (1875); Bailey, Queensl. Fl. **6**: 1786 (1902); Domin, Bibl. Bot. **20**: Heft. 85,



471 (1915); Kükenth. in Fedde, Repert. **44**: 24 (1938); Ohwi, Cyper. Japon. **2**, 28 (1914); S. T. Blake in Journ. Arn. Arb. **29**: 90 (1948).

*Sch. elatus* Böcklr. in Flora **68**: 117 (1875).—‘*Cladium undulatum* Thw.’: Henry, List. Pl. Formos. 105 (1896).—*Lophocarpus tonquinensis* Böcklr. in Allg. Bot. Zeitschr. **2**: 111 (1896).—*Neolophocarpus tonquinensis* (Böcklr.) E. G. Camus in Lecomte, Fl. Génér. Indo-Chine **7**: 148 (1912).

Ryukyus (Is. Okinawa, Is. Kumeshima, Is. Iheyajima), Formosa—Indo-China (Tonkin), Malaysia, Australia.

**146. *Schoenus brevifolius*** R. Brown, Prodr. Fl. Nov. Holl. **1**, 231 (1810); Kunth, Enum. Pl. **2**: 355 (1837); Steudel, Synops. Pl. Glumac. **2**: 165 (1855); Böcklr. in Linnaea **38**: 283 (1774); Bentham, Fl. Austral. **7**: 370 (1878); Bailey, Queensl. Fl. **7**: 1875 (1902); Rendle in Journ. Linn. Soc. **45**: 261 (1921); Kükenth. in Fedde, Repert. **44**: 68 (1938); T. Koyama in Journ. Jap. Bot. **32**: 150, f. 8 (1957).

*Sch. Hattorianus* Nakai in Bot. Mag. Tokyo **26**: 97 (1912); Ohwi, Cyper. Japon. **2**, 27 (1944), e typo.

Bonin Islands: Is. Chichijima, Hatsuneyama. Hattori & Kawate s. n. (Type of *Sch. Hattorianus* Nakai in (TI!); Chichijima, Takeda Pasture. T. Tuyama. (TI!)—Australia, New Caledonia.

An example of Australian-Bonin link. This distinct species has not been recorded in the Pacific islands. Kükenth. (1938), without seeing any authentic material, supposed that *Sch. Hattorianus* is identical with *Sch. melanostachyus* presumably because of the geographical area related, however, as I stated previously, Bonin plants exactly coincides with various specimens from Queensland. I am also unable to distinguish *Sch. tenax* of New Zealand specifically from it, only difference from typical *Sch. brevifolius* is longer panicles and longer branches.\*

**147. *Schoenus apogon*** Römer & Schultes, Syst. Veg. **2**: 77 (1817); Cheeseman, Man. N. Zeal. Fl. 783 (1906); Domin in Bibl. Bot. **20**: Heft 85, 475 (1915); Ridley in Trans. Linn. Soc. Bot. Ser. **2**: 243 (1916); Kükenth. in Fedde, Repert. **44**: 91 (1938); Ohwi, Cyper. Japon. **2**, 27 (1944) & Fl. Japan 221 (1953).

*Chaetospora imberbis* R. Br., Prodr. Fl. Nov. Holl. **1**, 233 (1810); Kunth, Enum. Pl. **2**: 327 (1837); Steudel, Synops. Pl. Gl. **2**: 162 (1855); Böcklr. in Linnaea **38**: 299 (1874).—*Sch. imberbis* Poiret, Encycl. Meth. Suppl. **2**: 251 (1811); non R. Br. (1810).—*Isolepis margaritifera* Nees in Ann. Nat. Hist. Ser. **1**, **6**: 46 (1841); Steud., Synops. Pl. Gl. **2**: 94 (1855).—*Sch. Brownii* Hook. f., Handb. N. Zeal. Fl. 298 (1867); Bentham, Fl. Austral. **7**: 373 (1878).—*Chaetospora albescens* Franch. & Savat., Enum. Pl. Japon. **2**: 122 (1877) & 548 (1879).—*Sch. albescens* (Fr. & Sav.) Matsumura, Catal. Herb. Univ. Imp. Tokyo, 219 (1886); Makino in Bot. Mag. Tokyo **12**: (15) (1898), omnino comb. nud.—*Chaetospora umbellulifera* Böcklr. in Flora **65**: 28 (1882).—*Heleothrix imberbis* (R. Br.) Palla in Allg. Bot. Zeitschr. **8**: 68 (1902).

Honshu (Kadzusa, Kinki district and westwards), Shikoku, Kyushu, Ryukyus, Formosa—Malaysia, Australia. Open wet places, often in rice paddy. Japanese name: *Hatagaya*.

\* *Schoenus brevifolius* R. Br. var. **tenax** (Hook. f.) T. Koyama, stat. nov.—*Chaetospora tenax* Hook. f., Fl. N. Zeal. **1**: 274 (1853)—*Sch. tenax* (Hook. f.) Hook. f., Handb. N. Z. Fl. 298 (1867).

Genus 10. *RHYNCHOSPORA* Vahl.

Of more than 180 species of the genus *Rhynchospora*, grouped into 22 sections by Kükenthal in his monograph, *Vorarbeiten zu einer Monographie der Rhynchosporoideae*, the genus is represented only by 9 species of 4 sections in Japan as far as is known. The species of *Rhynchospora* are more abundant in tropical and warm regions of the New World than any other region of the Old World, and the genus is morphologically very uniform. In such a case, to make the classification of supraspecific groups within the genus without seeing enough material from the centre of genus, is undesirable. For this reason, the following system was adapted from Kükenthal, with some nomenclatorial emendation by Kern (in *Blumea* 9: 229-230, 1958). I, however, do not regard any subgenus, because I am unable to find any decisive character to support that. Kükenthal and others divided the genus into two subgenera, viz. *Haplostylis* with simple styles and *Diplostyleae* with 2-cleft styles. In this case, the former subgenus is very heterogeneous and it can be further divided into two by the spikelets being terete in *Calyptostylis*, and being strongly bilaterally compressed in *Haplostylis* sensu stricto.

Sect. 1. *Rhynchospora*.

Ser. *Dichostyleae* Benth. & Hook. f., *Gen. Pl.* 3: 1059 (1883)—Subgen. *Distylis* Pax in Engl. & Pr., *Nat. Pflanzenfam.* 2 (2): 117 (1887)—Ser. *Diplostyleae* C. B. Clarke in Hook. f., *Fl. Brit. Ind.* 6: 671 (1893)—Sect. *Glaucæ* C. B. Clarke in Urban, *Symb. Antill.* 2: 106 (1900)—Subgen. *Diplostyleae* (C. B. Clarke) Kükenth. in Engl., *Bot. Jahrb.* 74: 500 (1959)—Sect. *Stenophyllae* Kükenth. in Engl., *Bot. Jahrb.* 75: 142 (1950).

Type: *Rhynchospora alba* (Linn.) Vahl.

Sect. 2. *Longirostres* Kunth, *Enum. Pl.* 2: 292 (1837), emend. Kern in *Blumea* 9: 230 (1958).

Gen. *Calyptostylis* Nees & Meyen ex Nees in *Linnaea* 9: 295 (1934)—Gen. *Celatoschoenus* Nees & Meyen ex Nees, l. c. 296—Sect. *Calyptostylis* (Nees & Mey.) Benth. & Hook. f., *Gen. Pl.* 3: 1060 (1883)—*Haplostyleae-Paniculatae* C. B. Clarke in Hook. f., *Fl. Brit. Ind.* 6: 670 (1893)—Sect. *Aureae* C. B. Clarke in *Kew Bull. Add. Ser.* 8, 118, (1908).

Ser. A. *Longirostres*. Type: *Rhynchospora longirostris* Ell. (= *Rh. corniculata* A. Gray).

Ser. B. *Echinoschoenus* (Nees & Mey.) T. Koyama, stat. nov.

Gen. *Echinoschoenus* Nees & Meyen ex Nees in *Linnaea* 9: 297 (1834)—Sect. *Echinoschoenus* (Nees & Mey.) Benth. & Hook. f., *Gen. Pl.* 3: 1060 (1883)—*Haplostyleae-Polycephalae* C. B. Clarke in *Kew Bull. Add. Ser.* 8, 118 (1908)—Sect. *Polycephalae* (C. B. Clarke) C. B. Clarke in Urban, *Symb. Antill.* 2: 104 (1900).

Type: *Echinoschoenus triceps* (Vahl) Nees (= *Rh. cyperoides* Martius).

Sect. 3. *Capitatae* Kunth, *Enum. Pl.* 2: 288 (1837), emend. T. Koyama.

Gen. *Pterotheca* Presl, *Symb. Bot.* 1: 56 (1832)—*Haplostylis* Nees & Meyen ex Nees in *Linnaea* 9: 295 (1834)—*Diplochaete* Nees & Meyen ex Nees, l. c. 296—*Sphaeroschoenus* Nees in *Nova Acta Acad. Nat. Cur.* 19, Suppl. 1: 97 (1843)—*Trichochaeta* Steudel, *Synops. Pl. Glumac.* 2: 155 (1855)—Sect. *Haplostylis* (Nees & Mey.) Benth. & Hook. f., *Gen. Pl.* 3: 1059 (1883)—Sect. *Sphaeroschoenus* (Nees) C. B. Clarke in Hook. f., *Fl. Brit. Ind.* 6: 668 (1893)—Sect. *Pauciflorae* Kükenth. in Engl., *Bot. Jahrb.* 74: 479 (1949), incl. subsectiones *Plumoso-setosae* & *Scabro-setosae* Kükenth.

Type: *Rhynchospora capitata* (Humb. & Kunth) Römer & Schult. (Lectotype).

1. Styles 2-cleft. (§ **Rhynchospora**)
    2. Floral scales brown; perianth bristles usually 6 to a flower.
    3. Spikelets 8 to 9 mm long; achenes narrowly obovate. ....148. *Rh. chinensis*
    3. Spikelets 3 to 6 mm long.
      4. Spikelets 5 to 6 mm long; achenes narrowly obovate, beak subulate-conical, attenuate. ....150. *Rh. Yasudana*
      4. Spikelets 3 to 4.5 mm long; achenes broadly obovate, beak conical, not attenuate.
        5. Spikelets sessile, in group of 1 to 5; perianth bristles slightly longer than achene; slender small plant less than 4 dm tall. ....151. *Rh. Faberi*
        5. Spikelets all peduncled, solitary; perianth bristles as long as or slightly shorter than achene; plant 6 to 10 dm tall. ....149. *Rh. rugosa*
    2. Floral scales white to ferrugineous-white; perianth bristles usually 8 to 15 to a flower. ....152. *Rh. alba*
  1. Styles simple or barely bifid at apex.
    6. Spikelets terete; floral scales spirally imbricate; achenes dorsiventrally lenticular; inflorescence of several to many heads of fascicles of spikelets. (§ **Longirostres**)
      7. Inflorescence corymbose with many clusters of spikelets. (Ser. *Longirostres*) ....153. *Rh. corymbosa*
      7. Inflorescence spikelike with few to several heads. (Ser. *Echinoschoenus*) ...154. *Rh. malasica*
    6. Spikelets bilaterally compressed; floral scales 2-ranked; achenes bilaterally compressed; inflorescence of a single head. (§ **Capitatae**)
      8. Achenes hispidulous-scabrous above, less than 2 mm long; perianth bristles shorter than achene, nearly smooth at base, leaves less scabrous, erect-patent. ....155. *Rh. rubra*
      8. Achenes glabrous above, more than 2 mm long; perianth bristles as long as to longer than achene, white-hairy at base; leaves prominently scabrous on margins and along keel, strongly recurved. ....156. *Rh. parva*
- 148. *Rhynchospora chinensis*** Nees & Meyen (ex Nees in *Linnaea* 9: 297. 1834. nomen nudum) ex Wight, *Contrib. Bot. India* 115 (1834), pro parte, excl. pl. Wallich. (cf. Merrill in *Journ. Arn. Arb.* 18: 62. 1937); Böckeler in *Linnaea* 37: 586 (1837); Palla in *Mond. Plant.* 12: 39 (1910); E. G. Camus in *Lec., Fl. Génér. Indo-Chine* 7: 148 (1912); Ohwi, *Cyper. Japon.* 2, 18 (1944) & *Fl. Japan* 220 (1953); T. Koyama, in *Contrib. Inst. Bot. Univ. Montréal* no. 70, 56 (1957).
- '*Rh. laxa*': Bentham, *Fl. Hongk.* 397 (1862); Thwaites, *Enum. Pl. Zeyl.* 352 (1864).—*Rh. glauca* Vahl var. *chinensis* (Nees & Mey.) C. B. Clarke in *Hook. f., Fl. Brit. Ind.* 6: 672 (1893), in *Journ. Linn. Soc.* 36: 259 (1903) & *Illustr. Cyper.* t. 78 f. 8-11 (1909); Skottsberg in *Medd. Göteborg. Bot. Trädg.* 2: 213 (1925/26); Hand.-Mazzetti, *Symb. Sin.* 7, 1253 (1936); Chermeson in *Humbert. Fl. Madagascar* 29° fam., *Cypérac.* 223 (1937).—*Rh. japonica* Makino in *Bot. Mag. Tokyo* 17: 184, t. 7 f. 6 (1903).—*Rh. longisetigera* Hayata, *Icon. Pl. Formosa* 6: 116 (1916).—*Rh. glauca* Vahl subsp. *chinensis* (Nees & Mey.) Kükenth. in *Engl., Bot. Jahrb.* 75: 148 (1950).

Honshu (Mikawa, Kinki district and westwards), Shikoku, Kyushu, Ryukyus—Formosa, China, India, Malaysia, Australia, Africa. Marshy places chiefly on low hills. Japanese name: *Inuno-hanahige*.

When the epithet, *chinensis*, is applied to this species, the name is sometimes

cited as *Rh. chinensis* Bockeler (1837), and several specialists including S. T. Blake (in Journ. Arn. Arb. 29: 102. 1948) are of opinion that the legitimate name for this plant should be *Rh. japonica* Makino. In such a case, the name *Rh. chinensis* Nees & Meyen is treated to be synonymous with *Rh. rugosa* Gale. Originally, *Rh. chinensis* Nees & Mey. was based upon 2 plants, "In China ad Promontorium Syung-moon...Meyen...", and "Wallich 3421", of which the latter is, according to C. B. Clarke (in Journ. Linn. Soc. 36: 259. 1903), *Rh. glauca* Vahl (= *Rh. rugosa* Gale). But, because the former specimen is acceptable as Nees' type of *Rh. chinensis*, I retain the name *Rh. chinensis* Nees & Mey. based upon Meyen's plant, to this species. As for the typification of *Rh. chinensis*, H. Pfeiffer also interprets as "...Wallich's Pflanze wird von Nees nur also Synonyma zitiert. Die nomenclatorische Grundlage für *Rh. chinensis* ist also immer Meyen's Pflanze,..."

Many specialists including Clarke and Kükenthal, consider this plants not to be specifically distinct from *Rh. rugosa* Gale. In my opinion, it is, however, clearly separable from the latter in that the spikelets of the former are lanceolate, larger, and always clustered, bearing obovate achenes, while in the latter, smaller, ellipsoid spikelets are always solitary, bearing orbicular-obovate achenes.

var. **curvo-aristata** (Tuyama) Ohwi, Cyper. Japon. 2, 19 (1944).

*Rh. japonica* Makino var. *curvo-aristata* Tuyama in Bot. Mag. Tokyo 52: 567 (1938).

Bonin Islands: Is. Chichijima. T. Nakai s. n. (Type of *Rh. japonica* var. *curvo-aristata* in TI!), ibid. Takeda pasture. Tuyama s. n. (TI!).

A local population characterized by yellow-brown, more distinctly rugose achenes, terminated by a broader, distinct annule, floral scales often ending in brief excurrent awn, and more densely clustered corymbs.

var. **Fauriae** (Franchet) T. Koyama, stat. nov.

*Rh. Fauriae* Franchet in Bull. Soc. Philom. Pairs, 7<sup>e</sup> sér. 10: 104 (1886); Makino in Bot. Mag. Tokyo 17: 187, t. 7 f. 9. (1903); C. B. Clarke ex Léveillé in Bull. Acad. Intern. Géogr. Bot. 13: 197 (1904); Ohwi, Cyper. Japon. 2, 19 (1944) & Fl. Japan 220 (1953); Kükenth. in Engl., Bot. Jahrb. 75: 92 (1950), excl. synonym. *Rh. ouensansis* Koidz.

Chromosomes:  $2n=62$ .

Hokkaido (Ishikari, Iburi, Oshima), Honshu (Mimasaka, Yamato, Ise, Ohmi Central district and notheastwards). Marshy places in lowlands. Japanese name: *Oh-inunohanahige*.

*Rh. Fauriae* was placed by Kükenthal in the section *Albae*, a different one from the section of *Rh. rugosa* and *Rh. chinensis*, only for the reason that it has retrosely scabrous perianth bristles. The scabridity of bristles in *Rhynchospora* is very often indefinite. In *Rh. Faberi* or *Rh. Fujiiana*, for instance, bristles are variously scabrous, so that they puzzled Makino to make him describe so many species. From the achenes, that is only reliable character to deal with the species of *Rhynchospora*, *Rh. Fauriae* is more closely related to *Rh. chinensis* than to any other, and I consider it to be a geographic race fairly well differentiated in the northern part of Japan.

149. **Rhynchospora rugosa** (Vahl) Gale in Rhodora 46: 275, t. 835, f. 1 A-B (1944).

*Rh. glauca* Vahl, Enum. Pl. 2: 233 (1806).—*Schoenus rugosus* Vahl, Ecolog. 2: 5 (1798).—



*Rh. gracilis* Vahl, Enum. Pl. 2: 234 (1806).—*Dichromena glauca* (Vahl) Macbride in Public. Field Mus. Nat. Hist. Chicago, Bot. Ser 4: 166 (1929).

Tropical and subtropical America.

var. **condensata** (Kükenth.) T. Koyama, comb. nova & sensu emend.

*Rh. Brownii* Römer & Schult., Syst. Veg. 2: 86 (1817); Böckl. in Linnaea 37: 581 (1873); Ohwi, Cyper. Japon. 2, 20 (1944) & Fl. Japan 220 (1953); S. T. Blake in Journ. Arn. Arb. 29: 102 (1948).—*Rh. chinensis* Nees & Meyen ex Nees in Wight, Contrib. Bot. Ind. 115 (1834), quoad pl. Wallich.; Nees in Nova Act. Acad. Nat. Cur. 19, Suppl. 1: 108 (1843).—‘*Rh. glauca* Vahl’: Benth., Fl. Austral. 7: 379 (1878); C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 671 (1893), in Thesit.-Dyer, Fl. Trop. Afr. 8: 482 (1902), in Philip. Journ. Sci. 2: 107 (1907), et Illustr. Cyper. t. 73 f. 7 (1909); Makino in Bot. Mag. Tokyo 17: 185, t. 7, f. a-c (1903); Palla in Denks. Akad. Wiss. Wien, Math.-Naturwiss. Kl. 79: 189 (1906); Hayata, Icon. Pl. Formos. 6: 116 (1916); Kükenth. in Fedde, Repert. 23: 210 (1926) & in Engl., Bot. Jahrb. 75: 143 (1950) excl. syn. *Rh. ponapensem* Hosok.; H. Pfeiffer in Fedde, Repert. 33: 211 (1933); Chermeson in Humbert, Fl. Madagascar. 29<sup>e</sup> fam., Cypérac. 222 (1937).—*Rh. glauca* Vahl var. *condensata* Kükenth. in Engl., Bot. Jahrb. 69: 259 (1938) & 75: 148 (1950) as forma.—*Rh. Brownii* Römer & Schult. var. *condensata* (Kükenth.) Ohwi in Bot. Mag. Tokyo 56: 205 (1942).

Honshu: Tohtohmi, between Miyaguchi and Miyakoda. T. Omura 17569 (auct. herb. !); Kii, Shinjomura. T. Koyama s. n. (TI !); Kii, Tanabe-Nakahama. K. Mihashi 257 (auct. herb. !); Kii, Kumanogawa valley, Oguchi. Y. Ogawa s. n. (auct. herb. !); Settsu, Rokkosan. Z. Yoshino (KYO !); Nagato, Ninose. T. Oda (KYO !);—Shikoku; Kyushu, Ryukyus, Formosa—Africa, India, S. China, Malaysia, N. Australia. Open wet places, uncommon. Japanese name: *Torano-hanahige*.

Plants from the Old World differ from those of America by slightly larger spikelets, and more obscurely rugose achenes crowned by more deltoid-conical stylebase, so that, if they are separated from the latter specifically, the correct name is *Rh. Brownii*. I keep them in a varietal relationship, regarding them to have been slightly differentiated within a cosmotropic species. Kükenth. var. *condensata* from Papuasias falls within the variation range of Africo-Asiatic population, and the name has varietal priority. So far as I saw specimens, plants from tropical Africa and Madagascar Is. well agree with those from tropical Asia in having perianth bristles slightly longer than those in Japanese plants as a rule.

**150. Rhynchospora Yasudana** Makino in Bot. Mag. Tokyo 17: 188, t. 7, f. 10 (1903); Ohwi, Cyper. Japon. 2, 20 (1944) & Fl. Japan 220 (1953); Kükenth. in Engl., Bot. Jahrb. 75: 96 (1950), pro minima parte! excl. synonym.

*Rh. Franchetiana* C. B. Clarke (ex Léveillé in Bull. Acad. Intern. Géogr. Bot. 14: 197 (1904) ex pte!, nomen) in Kew Bull. Add. Ser. 8, 119 (1908).

Hokkaido: Mt. Muine. I. Yamamoto (KYO !); Mt. Furanodake. M. Furuse (auct. herb. !)—Honshu (northeastern district, Kodzuke, Shimotsuke, Yetchu). Cool marshy places and high moor. Japanese name: *Miyama-inunohanahige*.

A typical boreal-Japanese element. This is well characterized by relatively low, robust culms with rather broad leaf blades and often solitary spikelets.

var. **levisetia** (C. B. Clarke ex Léveillé) T. Koyama, comb. nova.

*Rh. Fujiiana* Makino in Bot. Mag. Tokyo 17: 183, t. 7, f. 3 (1903); Ohwi, Cyper. Japon. 2, 21 (1944) & Fl. Japan 220 (1953); Kükenth. in Engl., Bot. Jahrb. 75: 151 (1950).—*Rh.*

*Fauriei* Franch. var. *leviseta* C. B. Clarke ex Léveillé in Bull. Acad. Intern. Géogr. Bot. **14**: 197 (1904).—*Rh. Franchetiana* C. B. Clarke (ex Léveillé, l. c. **14**: 197 (1904), ex pte. nomen) in Kew Bull. Add. Ser. 8, 119 (1908).—*Rh. coreana* Palla in Österr. Bot. Zeitschr. **59**: 186, t. 3, f. 1 (1909).—‘*Rh. Miyakeana* Makino’: Nakai, Fl. Korean. **2**: 298 (1911).—‘*Rh. Yasudana* Makino’: Kükenth. in Engl., Bot. Jahrb. **75**: 96 (1950), pro majore parte!

The following forms are separated:

forma **leviseta**.—Perianth bristles smooth.

forma **scabriseta** (Makino) T. Koyama, stat. nov.—*Rh. Fujiiana* Makino var. *scabriseta* Makino, l. c. 148, t. 7, f. 4 (1904); Kükenth. in Engl., l. c. 152 (1950).—Perianth bristles upwardly scabrous.

forma **retrorsocabra** (Takeda) T. Koyama, stat. nov.—*Rh. Fujiiana* Makino var. *retrorsocabra* Takeda in Bot. Mag. Tokyo **24**: 111 (1910).—Perianth bristles retrorsely scabrous.

Hokkaido (s. part), Honshu, Shikoku, Kyushu, Korea, (s. part). Open and shady wet places in lowlands and on low hills, often with other sedges. Japanese name: *Ko-inunohanahige*.

This species is a distinct Japanese endemic. The taxonomic affinity is found in *Rh. capillacea* Torrey, a North American filiform beak rush.

As Kükenth. confused *Rh. Yasudana* with *Rh. Fujiiana*, both are very similar in every respect. Ohwi distinguished *Rh. Yasudana* from *Rh. Fujiiana* chiefly by the shape of achenes, describing that as ‘anguste oblongo’ in the former and as ‘obovato’ in the latter, and presumably on the ground that *Rh. Yasudana* has more or less distinct rhizome. Having carefully compared various ranges of variations of both entities, I found myself unable to see such a difference in the shape of achenes, however. Concerning the rhizome of *Rh. Yasudana*, various degrees of evolution were found even in the same colony. Being restricted in the high moore and strictly not mixed with one another, *Rh. Yasudana* would have been differentiated as an alpine population of the lowland var. *leviseta*.

**151. Rhynchospora Faberi** C. B. Clarke in Journ. Linn. Soc. **36**: 259 (Oct. 1903) & in Kew Bull. Add. Ser. 8, 119 (1908); Ohwi, Cyper. Japan. **2**, 22 (1944) & Fl. Japan **220** (1953); Kükenth. in Engl., Bot. Jahrb. **75**: 94 (1950); Ohwi & T. Koyama in Bull. National Sci. Mus. N. S. **3**: 31 (1956).

*Rh. Miyakeana* Makino in Bot. Mag. Tokyo **17**: 184, t. 7, f. 5 a-b (Nov. 1903); Kükenth. in Engl., Bot. Jahrb. **75**: 95 (1950).—*Rh. Umemurae* Makino, l. c. 187, t. 7, f. 8 a-b (Nov. 1903).—*Rh. Hattoriana* Makino, l. c. 189, t. 7, f. 11 (Nov. 1903).—‘*Rh. Fauriae* Franchet’: C. B. Clarke ex Léveillé in Bull. Acad. Intern. Géogr. Bot. **14**: 197 (1904), excl. var.; Roshev. in Komar., Fl. URSS. **3**: 104, t. 5, f. 9 (1935).—*Rh. breviseta* Palla in Österr. Bot. Zeitschr. **95**: 187 (1909).—*Rh. Umemurae* Makino var. *exigua* Takeda in Bot. Mag. Tokyo **24**: 174 (1910).—*Rh. ouensanensis* Koidzumi in Bot. Mag. Tokyo **43**: 389 (1929).—*Rh. Umemurae* Makino var. *kiusiana* Honda in Bot. Mag. Tokyo **44**: 699 (1930).—*Rh. Umemurae* Makino var. *yakusimensis* Masamune in Trans. Nat. Hist. Soc. Formosa **23**: 210 (1933).—*Rh. yakusimensis* (Masam.) Masamune in Mem. Fac. Sci. & Agr. Taihoku Imper. Univ., Bot., No. 4, 522 (1934); Kükenth. in Engl., l. c. 103 (1950).

Perianth bristles are very variable:

forma **Faberi**.—Bristles retrorsely scabrous.

forma **Umemurae** (Makino) Ohwi & T. Koyama, in Bull. National Sci. Mus. N. S. **3**: 31

(1956)—*Rh. Umemurae* Makino, l. c.—*Rh. Faberi* C. B. Clarke var. *Umemurae* (Makino) Ohwi, Cyper. Japon. 2, 22 (1944); Kükenth. in Engl., l. c. 95 (1950).—Bristles upwardly scabrous.

forma **breviseta** (Palla) Ohwi & T. Koyama, l. c. 31 (1956).—*Rh. breviseta* Palla, l. c.—*Rh. Faberi* Clarke var. *breviseta* (Palla) Ohwi, l. c. 22; Kükenth., l. c. 95.—Bristles shorter than achene, smooth or upwardly scabrous.

forma **exigua** (Takeda) Ohwi & T. Koyama, l. c. 31 (1956)—*Rh. Umemurae* Makino var. *yakusimensis* Masamune, l. c.—*Rh. Faberi* Clarke var. *exigua* (Takeda) Ohwi, l. c. 22.—Bristles smooth.

Hokkaido, Honshu, Shikoku, Kyushu, Korea—central and southeastern China. Wet places both in lowlands and on mountains, common. Japanese name: *Ito-inunohanahige*.

**152. *Rhynchospora alba*** (Linn.) Vahl, Enum. Pl. 2: 236 (1806), scil.  $\alpha$ ; Sprengel, Syst. Veg. 1: 14 (1825); Reichenb., Icon. Fl. 8: t. 285, f. 678 (1846); Anderson, Fl. Scand. 1: 3, t. 1, f. 6 (1849); Ma COUN, Cat. Canad. Pl. 4: 17 (1888); Neum., Sver. Fl. 670 (1901); Makino in Bot. Mag. Tokyo 17: 180, t. 7, f. 12 a-b (1907); Aschers. & Graebn., Synops. Mitteleur. Fl. 2(2): 344 (1904); Britt. & Brown, Illustr. Fl. N. U. S. 1: 343 f. 844 (1913); Hultén, Fl. Kamtsch. 1: 171 (1927); Gale in Rhodora 46: 121, t. 819, f. 4 A-B (1944); Ohwi, Cyper. Japon. 2, 23 (1944) & Fl. Japan 221 (1953); Fernald, Gray's Man. Bot. ed. 8, 285, f. 470 (1950); Kükenth. in Engl., Bot. Jahrb. 75: 91 (1950).

*Schoenus albus* Linn., Sp. Pl. ed. 1, 44 (1753); Meinsh. in Act. Hort. Petropol. 18: 234 (1901).—*Mariscus albus* (Linn.) Gilib., Exerc. 2: 512 (1792).—*Rh. alba* Vahl var. *kiusiana* Makino in Bot. Mag. Tokyo 17: 191 (1903); Kükenth., l. c. 93 (1950).—*Triodon album* (Linn.) Farwell in Rep. Michig. Acad. Sci. 19: 253 (1917).—*Phaeocephalum album* (Linn.) House in Amer. Midl. Natur. 6: 201 (1920).—*Dichromena alba* (Linn.) Macbride in Public. Field Mus. Nat. Hist. Chicago, Bot. Ser., 4: 166 (1929).

Kyushu: Hiuga, Tsuno. Saida & Sakurai (ex Makino, l. c.); Mt. Kirishima. Z. Tashiro (KYO!); Chikuzen, Yunoso. Y. Nabeshima (KYO!); Bungo, Lake Odake nr. Yufuin. T. Koyama, 7410 (auct. herb.!)—Honshu (Aki, Owari, Mino, Shinano, Tohtohmi, Yechigo, Kozuke, Shimotsuke, northeast district), Hokkaido—Circumboreal, also Florida, West Indies, N. Brasil (var. *Meridiana* H. Pfeiffer). Wet places and moor. Japanese name: *Mikadzuki-gusa*.

**153. *Rhynchospora corymbosa*** (Linn.) Britton in Trans. New York Acad. Sci. 11: 84 (1892) & in Contrib. Jardin Bot. N. Y. 194, 7 (1917); Hitchcock in Missouri Bot. Gard. Rep. 4: 141 (1893); Urban, Symb. Antill. 2: 167 (1900); Makino in Bot. Mag. Tokyo 17: 181, t. 7, f. 2 a-b (1903); Domin in Boil. Bot. 20: Heft 85, 468 (1915); H. Pfeiffer in Fedde, Rep. 17: 237 (1921); Kükenth. in Engl., Bot. Jahrb. 59: 7 & 52 (1924) & in Fedde, Repert. Beiheft. 40(1) A, 524 (1938); Lanjouw in Rec. Trav. Bot. Néerland. 32: 229 (1935); Ohwi, Cyper. Japon. 2, 17 (1944); T. Koyama in Contrib. Inst. Univ. Montréal 70, 56 (1957).

*Scirpus corymbosus* Linn., Amoen. Acad. 4: 303 (1760) & Sp. Pl. ed. 2, 76 (1762).—*Schoenus suriamensis* Rottb., Descr. & Icon. 68, t. 21, f. 1 (1773).—*Schoenus corymbosus* (Linn.) Persoon, Synops. 1: 56 (1805).—*Rhynchospora aurea* Vahl, Enum. Pl. 2: 229 (1806); Beauvois, Fl. d'Owar. 2: 39, t. 81, f. 2 (1807); R. Br., Prodr. 1, 230 (1810); Miquel, Fl. Ind. Batav. 3: 336 (1859); Benth., Fl. Austral. 7: 348 (1878); C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 670 (1893) & in Thyselt.-Dyer, Fl. Trop. Afr. 8: 480 (1902); Suringer in Lorentz, Nov. Guinea 8: 706 (1912); Chermeson in Humbert, Fl. Madagascar 29<sup>e</sup> fam., Cypér. 218 (1937).



—*Rh. articulata* Römer & Schult., Syst. Veg. Mant. **2**: 49 (1824).—*Calyplostylis Gaudichaudii* Nees & Mey. ex Nees in Linnaea **9**: 259 (1834).—*Calyplostylis articulata* (Römer & Schult.) Nees in Hook., Journ. Bot. **2**: 394 in observ. (1840).

Ryukyus: Is. Iriomote, nr. Hoshitate, in abandoned rice paddy. T. Koyama s. n. (auct. herb.!) Is. Ishigaki. S. Tawada (KYO)—Formosa—Cosmotropic. Wet or marshy places such as rice paddy.

- 154. *Rhynchospora malasica*** C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 670 (1893) & in Kew Bull. Add. Ser. **8**, 118 (1908); Merrill, Bibl. Enum. Born. Pl. **63** (1921); Kükenth. in Bull. Jard. Bot. Buitenz. 3<sup>e</sup> sér., **16**: 303 (1940) & in Engl., Bot. Jahrb. **74**: 438 (1949); Ohwi, Fl. Japan **220** (1953); Kern in Reinwardtia **4**: 97 (1956).

*Rh. nipponica* Makino in Bot. Mag. Tokyo **18**: 145 (1908); Ohwi, Cyper. Japon. **2**, 17 (1944).

Honshu: Mikawa, Imo. T. Koyama 7431 (auct. herb.!) ; Mikawa, Futagawa. Umemura 90 (ex Makino l. c.); Ise, Miyemura. K. Inami 5791 (auct. herb.!) ; Kii, Seto-Kanayama. T. Nakajima s. n. (KYO!)—Kyushu: Hizen, Tsukabaru. S. One s. n. (KYO!) ; Chikugo, Yunoso. Y. Nabeshima (KYO!) ; Hiuga, Kawaminami-mura, west of Shinchaya. T. Koyama 7036 (auct. herb.!) ; Satsuma, Hatsuki-mura. Z. Tashiro (KYO!)—Ryukyus: Is. Okinawa. S. Tawada s. n. (KYO!)—Formosa; Lake Jitugetsutan. S. Miki (KYO!)—Malaya: Griffith 6358 (K); Singapore. Ridley 80 (K, SING)—Malaysia: Borneo, Banka, Bunnemeijer 1959 (Bt); Sarawak. J. Hewitt (SAR). Open grassy marsh; in shallow water; scarce and local. Japanese name; *Mikuri-gaya*.

Poorly collected, quite characteristic species. Some ecological factors may be causing this disjunct occurrence. In every locality where I met it, I could collect only few individuals.

- 155. *Rhynchospora rubra*** (Lour.) Makino in Bot. Mag. Tokyo **17**: 180, t. 7, f. 1 a-b (103); excl. syn. *Rh. parva*; Merrill, Fl. Manila **119** (1912) & Enum. Philip. Flow. Pl. **1**: 130 (1922); Domin in Bibl. **20**, Heft. 85, 468 (1915); Kükenth. in Engl., Bot. Jahrb. **59**: 6 & 52 (1925) & **74**: 491 (1949); H. Pfeffer in Mitteil. Inst. Bot. Hamburg **7** (2): 173 (1928); Hand.-Mazzetti, Symb. Sin. **7**, 1253 (1936); Ohwi, Cyper. Japon. **2**, 16 (1944) & Fl. Japan **219** (1953); T. Koyama in Contrib. Inst. Bot. Univ. Montréal **70**, 56 (1957).

*Schoenus ruber* Loureiro, Fl. Cochinch. **1**: 52 (1790); Vahl, Enum. Pl. **2**: 213 (1806); Spreng., Syst. Veg. **1**: 189 (1825); Kunth, Enum. Pl. **2**: 336 (1837).—*Rh. Haenkei* Presl, Rel. Haenk. **1**: 199 (1830); Kunth, Enum. Pl. **2**: 290 (1837); Steudel, Synops. Pl. Gl. **2**: 148 (1855) Miquel, Fl. Nederl. Ind. **3**: 336 (1859).—*Morisia Wallichii* Nees ex Wight, Contrib. Bot. India **115** (1834).—*Morisia capitata* Nees in Linnaea **9**: 295 (1834), nomen nudum.—*Haplostylis Meyenii* Nees (in Linnaea **9**: 295. 1834. nomen nudum) ex Wight, Contrib. Bot. Ind. **115**(1834).—*Sphaeroschoenus Wallichii* (Nees) Arnott & Nees in Nova Act. Acad. Nat. Cur. **19**, Suppl. **1**: 97 (1843).—*Rh. Wallichiana* Kunth, Enum. Pl. **2**: 289 (1837); Steudel, Synops. Pl. Gl. **2**: 148 (1855); Miq., Fl. Nederl. Ind. **3**: 335 (1859); Bentham, Fl. Hongk. **396** (1862) & Fl. Austr. **7**: 349 (1878); Suringar in Lorentz, Nova Guinea **8**: 706 (1912).

Honshu: (Kadzusa, Tohotohmi, Mikawa, Kinki district and westwards), Shikoku, Kyushu, Ryukyus—Formosa, S. China, Malaysia, N. Australia, India. Wet or slightly dry sunny ground usually with very poor vegetation. Japanese name: *Iga-kusa*.

This Indo-Malysian element extends its area northwards to Boso peninsula in Japan, where is the northeastern limit of many Malysian elements in eastern Asia. In Malysian and Indo-Chinese plants, styles are sometimes very shallowly 2-fid at



the apex, but in Japanese plants they are never divided at all.

**156. *Rhynchospora parva*** (Nees) Steudel, Synops. Pl. Glumac. **2**: 148 (1855), excl. locality; Kükenth. in Engl., Bot. Jahrb. **74**: 489 (1949); Raymond in Nat. Canad. **84**: 172 (1957).

*Cephaloschoenus parvus* Nees (in Linnaea **9**: 296, 1834, nomen nudum) in Nov. Act. Acad. Nat. Cur. **19**, Suppl. **1**: 100 (1834).—*Chaetospora madagascariensis* Steudel, Synops. Pl. Gl. **2**: 161 (1855); C. B. Clarke in Dur. & Schinz, Consp. Fl. Afr. **5**: 656 (1895).—‘*Rh. Wallichiana* Kunth’: C. B. Clarke, l. c. **5**: 655 (1895) & auct. plur.—*Rh. madagascariensis* (Steud.) Chermeson in Bull. Soc. Bot. France. **71**: 143 (1924), & in Humbert, Fl. Madag. 29<sup>e</sup> fam., Cypér. 216. t. 20, f. 1–3 (1937).—*Rh. minor* Nelmes in Kew Bull. **1956**: 533 (1956).

Distrib. Tropical Africa, Madagascar Is.

var. **boninensis** (Nakai ex Tuyama) T. Koyama, stat. nov.

*Rh. boninensis* Nakai (in Rigakkwai **26**: 10, 1928, nomen) ex Tuyama in Bot. Mag. Tokyo **49**: 511 (1935); Ohwi, Cyper. Japon. **2**, 16 (1944).

Bonin Islands: without definite locality. Kawate. no. 2, (Type of *Rh. boninensis* in TI!); Is. Chichijima, Takeda Pasture. T. Tuyama (TI!) Is. Anishima. T. Nakai (TI!).

I have no hesitation to reduce *Rh. boninensis*, a Bonin endemic, to a variety of African *Rh. parva*. Var. *boninensis* differs from *Rh. parva* only by its slightly larger spikelets and slightly broader leaves. The achenes of both are exactly agree; the apices of them somewhat annulate-truncate with a broad stylebase; perianth bristles, up to twice as long as the body of achenes, are pilose at the base, etc. It is of geographical interest that this species makes a remarkable discontinuous distribution, being quite absent in tropical Asia, Pacific islands, and in tropical America.

## Genus 11. *SCLERIA* Bergius.

A large pantropic genus, of which the thorough revision is now badly needed. In most species, the size and the hairiness of the vegetative parts vary to a great extent in accordance with the ecological factors of the localities. The species represented in Japan are widely distributed in the Old World tropics and thus they mark their northern limit in Japan, and the specimens from Japan appear in a depauperated form usually. Furthermore, some perennials appear as annuals. Recently, *Scleria mikawana*, which was described from the mainland of Japan, has been found in India, New Guinea and as far as in tropical Africa. None would have expected such a wide distribution. This genus is really very difficult to treat critically in Japan. Only reliable character seems to be the achenes with their hypogynia of varying shape.

### Subgenus I. *Scleria*.

Section 1. **Hypoporum** (Nees) Endlicher, Gen. Pl. 112 (1836); Nelmes in Kew Bull. **1956**: 111 (1956).

Gen. *Hypoporum* Nees in Journ. Edinb. Phil. Soc. **17**: 266 (1834) & in Martius, Fl. Brasil. **2** (1): 169 (1842).

Type: *Hypoporum gracile* Nees (= *Scl. pergracilis* (Nees) Kunth).

### Section 2. *Scleria*.

Type: *Scl. mitis* Bergius. (Ser. *Scleria*=*Ophryoscleria*).

Ser. a) **Elatae** (C. B. Clarke) T. Koyama, stat. nov.—Sect. *Elatae* C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 689 (1893).

Type: *Scl. terrestris* (Linn.) Fassett (= *Scl. elata* Thwaites).

Ser. b) **Tessellatae** (C. B. Clarke) T. Koyama, stat. nov.—Sect. *Tessellatae* C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 686 (1893).

Type: *Scl. tessellata* Willdenow.

Subgen. II. **Diplacrum** (R. Br.) T. Koyama, stat. nov.

Gen. *Diplacrum* R. Br., Prodr. Fl. Nov. Holl. 1, 241 (1810)—Gen. *Pteroscleria* Nees in Linnaea 9: 303 (1834).

Type: *Diplacrum caricinum* R. Br. (= *Scl. caricina* (R. Br.) Bentham).

1. Partial inflorescences of a panicle. (Subgen. SCLERIA)
  2. Spikelets androgynous and staminate, inflorescences spike-like; hypogynium hardly developed (Sect. *Hypoporum*)
    3. Inflorescence with leaf-like bract; perennials with more or less elongate rhizome. ....157. *Scl. lithosperma*
    3. Inflorescence without leaf-like bract; annuals with fibrous roots only....158. *Scl. pergracilis*
  2. Spikelets unisexual, inflorescence of terminal and lateral panicles; hypogynium distinct. (Sect. *Scleria*)
    4. Small to medium-sized plants, usually annual with fibrous roots only; culms less than 90 cm tall; panicles scattered on nearly the total length of culms. (Ser. *Tessellatae*)
      5. Achenes tessellate.
        6. Disc-lobes of achenes acute at apex.
          7. Achenes pubescent.
            8. Disc-lobes coriaceous, ovate; leaf-sheaths winged. ....159. *Scl. parvula*
            8. Disc-lobes membranous, subulate, 1/2 to 1/3 as tall as achene; leaf-sheaths scarcely to narrowly winged. ....160. *Scl. biflora*
          7. Achenes glabrous; leaf-sheaths not winged, very tightly surrounding culm. ....161. *Scl. mikawana*
        6. Disc-lobes of achenes rounded to very obtuse at apex. ....162. *Scl. rugosa*
      5. Achenes quite smooth ....163. *Scl. annularis*
    4. Large perennials with ligneous, thick rhizome; culms, when normally grown, 1 to 3 m tall; panicles born in the apical part of culms only. (Ser. *Elatae*)
      9. Achenes dark brown to blackish; hypogynium cup-like about 1/2 as tall as achene. ....164. *Scl. sumatrensis*
      9. Achenes whitish; hypogynium of a trilobed disc.
        10. Disc-lobes semicircular, very obtuse at apex. ....165. *Scl. terrestris*
        10. Disc-lobes ovate-deltoid, acute at apex ....166. *Scl. levis*
1. Partial inflorescences of head at axil of leaf-like bract; small annuals 3—20 cm tall. (Subgen. DIPLACRUM). ....167. *Scl. caricina*

**157. *Scleria lithosperma*** (Linn.) Swartz, Prodr. Veg. Ind. Occid. 18 (1788); Nees in Wight, Contrib. Bot. Ind. 117 (1834); Kunth, Enum. Pl. 2: 349 (1837); Steudel, Synops. Pl. Gl. 2: 173 (1855); Bentham, Fl. Hongk. 399 (1861); Thwaites, Enum. Pl. Zeyl. 354 (1864); Böckeler in Linnaea 38: 451 (1874); Kurz in Journ.

Asiat. Soc. **45** (2): 159 (1873); C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 685 (1893), in Dyer, Fl. Trop. Afric. **8**: 502 (1902), in Journ. Linn. Soc. **36**: 265 (1903) & Illustr. Cyper. t. 123 (1909); Suringar in Lorentz, Nova Guinea **8**: 711 (1902); E. G. Camus in Lecomte, Fl. Génér. Indo-Chine **7**: 161, f. 25, 5 (1912); Sasaki, Catal. Govern't. Herb. Taihoku, 112 (1930); Hutchinson & Dalz., Fl. West. Trop. Afr. **2**: 491 & 493 (1936); Core in Brittonia **2**: 27 (1936); Ohwi in Bot. Mag. Tokyo **56**: 212 (1942); S. T. Blake in Journ. Arn. Arb. **35**: 224 (1954); Nelves in Kew Bull. **1955**: 421 (1955); T. Koyama in Contrib. Inst. Univ. Montréal **70**, 62 (1957).

*Scirpus lithospermus* Linn., Sp. Pl. ed. 1, 51 (1753).—*Schoenus lithospermus* (Linn.) Linn., Sp. Pl. ed. 2, 65 (1762).—*Scl. tenuis* Retzius, Observ. 4, 13 (1786).—*Scl. filiformis* Swartz, l. c. 19. (1788).—*Scl. capillaris* R. Brown, Prodr. Fl. Nov. Holl. 1, 240 (1810).—*Scl. glaucescens* Presl., Reliq. Haenk. **1**: 202 (1828).—*Hypoporum lithospermum* (Linn.) Nees in Martius, Fl. Brasil. **2** (1): 172 (1842).—*Hypoporum capillare* (R. Br.) Nees in Linnaea **9**: 303 (1834), comb. nud.—*Scl. Wightiana* Steudel, Synops. Pl. Gl. **2**: 176 (1855).—*Scl. puzzo-lanea* K. Schumann., Pflanzenw. Ost.-Afr. **C**: 129 (1895).

Formosa: Ako, Kuraru. T. Soma s. n. (TI!)—Cosmotropical.

For the other synonymy see Core (l. c.). This very common *Hypoporum* is found in the southern part of Formosa occasionally. Because Hayata did not record the Soma's specimen cited here in any of his publication related to Formosan flora, this species was cited by Ohwi (Cyper. Japon. 2, 10. 1944) as "species dubia."

**158. *Scleria pergracilis*** (Nees) Kunth, Enum. Pl. **2**: 354 (1837); Steudel, Synops. Pl. Gl. **2**: 176 (1855); Thwaites, Enum. Pl. Zeyl. 354 (1864); Bockeler in Linnaea **38**: 438 (1874); C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 685 (1893), in Dyer, Fl. Trop. Afr. **8**: 495 (1902) & Illustr. Cyper. t. 121 (1909); E. G. Camus in Lecomte, Fl. Génér. Indo-Chine **7**: 160, f. 21: 1-4 (1912); Merrill, Euum. Philip. Flow. Pl. **1**: 134 (1922); Hutchinson & Dalz., Fl. West. Trop. Afr. **3**: 491 & 493 (1936); Pierart in Lejeunia, Mém. **13**: 20, t. 4, f. 1-2 (1953); S. T. Blake in Journ. Arn. Arb. **35**: 224 (1954); Nelves in Kew Bull. **1955**: 445 (1955).

*Hypoporum pergracile* Nees in Edinb. New Philip. Journ. **17**: 267 (1834) & in Wight, Contrib. Bot. Ind. 118 (1834).—*Scl. pergracilis* Kunth var. *major* Chermeson in Bull. Soc. Bot. France **81**: 268 (1934).

Korea: Keinan, Tokusan. T. Mori 34 (TI!)—Africa, India, Ceylon, S. China, New Guinea.

A distinct species with a long, slender spike. The specimens from Korea well agrees with several specimens from India and Africa (Nigeria). This species was not included in Nakai's Flora Coreana, however Nakai added it in his key to the Korean *Scleria* published in Bot. Mag. Tokyo, **30**: 274 (1916).

**159. *Scleria parvula*** Steudel, Synops. Pl. Glumac. **2**: 174 (1855); Nelves in Kew Bull. **1956**: 105 (1956).

*Scl. uliginosa* Hochst ex Bockeler in Linnaea **38**: 471 (1874).—*Scl. fenestrata* Franch. & Savat., Enum. Pl. Japon. **2**: 122 (1877) & 549 (1879); Ohwi, Cyper. Japon. 2, 8 (1944) & Fl. Japan 218 (1953).—*Scl. tessellata* Willd.: C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 686-7 (1894) & ex Léveillé in Bull. Acad. Intern. Géogr. Bot. **3**: 203 (1904); Matsumura, Index Pl. Japon. **2** (1): 165 (1905); Nakai, Fl. Korean. **2**: 299 (1911).—*Scl. koreana* Palla ex Nakai in Bot. Mag. Tokyo **30**: 274 (1916) nomen in clave.—*Scl. bambariensis* Chermeson in Archiv.

Bot. Caen 4, Mém. 7: 48 (1931) & in Humbert, Fl. Madagascar 29<sup>e</sup> fam., Cypér., (1937).—*Scl. Schmitzii* Pierart in Lejeunia, Mém. 13: 42 t. 2, f-2 (1953).

Honshu (throughout the island), Shikoku, Kyushu, Korea central part and southwards)—Africa, Madagascar, India. Wet grasslands at low altitude. Japanese name: *Ko-shinjugaya*.

This species has been commonly called *Scleria tessellata*, which is very similar to *Scleria mikawana*. In normally grown individuals, this one is well defined by broad wings on bract sheaths. Besides winged sheaths, it is different from *Scleria tessellata* by slightly smaller, hairy achenes more or less glossy at the full maturity.

**160. *Scleria biflora*** Roxburgh, (Hort. Beng. 66. 1814 nomen), Fl. Ind. 3: 573 (1832); C. B. Clarke in Hook. f., Fl. Brit. 6: 687 (1894), in Journ. Linn. Soc. 36: 263 (1903) & Illustr. Cyper. t. 121 (1909); E. G. Camus in Lecomte, Fl. Génér. Indo-Chine 7: 163 (1912).

*Scl. propinqua* Steud., Syn. Pl. Glum. 2: (1855). [teste Kern, in litt.]—‘*Scl. tessellata* Willd.’: Kunth, Enum. 2: 343 (1837), p. p.; Bentham, Fl. Hongk. 339 (1861); Thwaites, Enum. Pl. Zeyl. 354 (1864).—*Scl. Steudeliana* Miquel, Fl. Ind. Batav. 3: 344 (1866); Böckeler in Linnaea 38: 475 (1874).—*Scl. ferruginea* Ohwi in Act. Phytotax. Geobot. 7: 37 (1938) & Cyper. Japon. 2, 7 (1944).

Ryukyus (Iriomote, Okinawa, Iheya), Formosa, (n. part)—India, China, Malay Peninsula,

**161. *Scleria mikawana*** Makino in Bot. Mag. Tokyo 27: 57 (1913); Ohwi, Cyper. Japon. 2, 7 (1944) & Fl. Japan 218 (1953); Nelmes in Kew Bull. 1956: 107 (1956).

*Scl. glabroreticulata* De Willd., Pl. Bequaert 4: 230, f. 4 (1927); Pierart in Lejeunia, Mém. 13: 43, t. 2, f. 9, 10, & 22 (1953).—‘*Scl. tessellata* Willd.’: C. B. Clarke in Hook. f., Fl. Brit. Ind. 6: 686 (1894), p. p.

Honshu: Kadzusa, between Mobara & Yatsumi. J. Ohwi & T. Koyama 961 (TI!, TNS!); Tohtohmi Mikawa, Futagawa. T. Makino Type of *S. mikawana* in TI!; Ohmi, Fuse. Ch. Hashimoto (KYO!); Tamba, Osadano. Y. Araki (KYO!)—Kyushu (more frequent)—India, Africa. Wet grasslands at low altitude. Japanese name: *Mikawa-shinjugaya*.

This is an example of Africo-Indian link reaching Japan. Except for its slightly smaller achenes and slightly slender habit, it closely resembles to *Scleria tessellata* Willd., sometimes called *Scleria grandiformis* Böckeler in Africa.

**162. *Scleria rugosa*** R. Brown, Prodr. Fl. Nov. Holl. 1, 240 (1810); Kunth, Enum. Pl. 2: 358 (1837); Steudel, Synops. 2: 179 (1855); F. v. Mueller, Fragm. Phytogr. Austral. 9: 32 (1875); Bentham, Fl. Austral. 7: 428 (1878); S. T. Blake in Journ. Arn. Arb. 35: 226 (1954); T. Koyama in Act. Phytotax. Geobot. 16: 11 (1955).

*Scl. lateriflora* Böckeler in Linnaea 38: 455 (1874).—*Scl. pubigera* Makino in Bot. Tokyo 27: 55 (1913).—*Scl. fenestrata* Franch. & Savat. var. *pubigera* (Makino) Ohwi in Bot. Mag. Tokyo 45: 190 (1931).—*Scl. Onoei* Franch. & Savat. var. *pubigera* (Makino) Ohwi, Cyper. Japon. 2, 9 (1944) & Fl. Japan 218 (1953).

Honshu (Kanto district and westwards), Shikoku, Kyushu, Ryukyus, Formosa—Malaysia, Austraria. Wet grasslands at low altitude. Japanese name: *Ke-shinjugaya*.

forma **glabrescens** (Koidz.) T. Koyama, stat. nov.

*Scl. Onoei* Franch. & Savat., Enum. Pl. Japon. 2: 122 (1877) & 549 (1879); Ohwi, Fl. Japan 218 (1952).—*Scl. tokusanensis* Nakai in Bot. Mag. Tokyo 30: 274 (1916), syn. nov. e typo!—*Scl. Onoei* Franch. & Savat. var. *glabrescens* Koidzumi in Act. Phytotax. Geobot. 9: 161



(1940); Ohwi, *Cyper. Japon.* 2, 9 (1944).—*Scl. rugosa* R. Br. var. *glabrescens* (Koidz.) Ohwi & T. Koyama in *Act. Phytotax. Geobot.* 16: 11 (1955).

Honshu (Kwanto district and westwards), Shikoku, Kyushu, Korea.—Japanese name: *Manekishinjugaya*.

Based upon a specimen from Formosa, determined as *Scl. pubigera* Makino, S. T. Blake (l. c.) reduced it to *Scl. rugosa* R. Br. Recently, having examined various specimens from New Guinea cited by Blake, I confirmed the Blake's treatment was quite correct. *Scl. Onoei* is a northern form of this Malaysian element, distinguishable from typical form by glabrous or nearly glabrous vegetative parts only.

**163. *Scleria annularis*** Kunth, *Enum. Pl.* 2: 359 (1837); Steudel, *Synops. Pl.* 2: 176 (1855); Böckeler in *Linnaea* 38: 456 (1874); C. B. Clarke in Hook f., *Fl. Brit. Ind.* 6: 687 (1894) & in *Journ. Linn. Soc.* 36: 263 (1903); Merrill, *Enum. Philip. Flow. Pl.* 1: 133 (1922).

*Hypoporum annulare* Nees in *Linnaea* 9: 303 (1834), nomen nudum.—*Scl. mutoensis* Nakai in *Journ. Jap. Bot.* 18: 421 (1942); Ohwi, *Cyper. Japon.* 2, 169 (1944), syn. nov. e typo!

Korea: Zennan, Mt. Mutosan. K. T. Cho, s. n. (Holotype of *Scl. mutoensis* in TI!)—India, China, Philippines.

According to the type, which is a sole specimen, *Scl. mutoensis* is a small form Korea of *Scl. annularis* of Chinese continent. This species is very distinct by the glabrous, smooth achenes with a truncate hypogynium. So far as I have seen specimens, this plant is distributed up to Hupeh in the China proper.

**164. *Scleria sumatrensis*** Retzius, *Observ.* 5, 19, t. 2 (1789); Kurz in *Journ. Asiat. Soc.* 45: 159 (1876); Ohwi, *Cyper. Japon.* 2, 5 (1944).

*Scl. setigera* Roxburgh, *Fl. Ind.* 3: 575 (1832).—*Scl. purpurascens* Steudel, *Synops. Pl. Glumac.* 2: 169 (1855).—*Scl. Fauriei* Ohwi in *Act. Phytotax. Geobot.* 1: 78 (1942).

Ryukyus: Is. Daito-jima. Tamori, s. n. (act. herb.!)—Formosa: Bankingsing. U. Faurie, 5 (Type of *Scl. Fauriei* in KYO!)—India, Malaysia, Micronesia.

New for the Ryukyu Islands. Outwardly resembling *Scl. margritifera*, *Scl. multifoliata* or *Scl. scrobiculata*, from which it is distinct by the achenes grayish-black when ripe.

**165. *Scleria terrestris*** (Linn.) Fassett in *Rhodora* 26: 159 (1924); S. T. Blake in *Journ. Arn. Arb.* 35: 228 (1954); T. Koyama in *Contrib. Inst. Bot. Univ. Montréal*, 70, 63 (1957).

*Zizania terrestris* Linn., *Sp. Pl.* ed. 1, 991 (1753).—*Diaphora cochinchinesis* Loureiro, *Fl. Cochinch.* 578 (1790).—*Olyra orientalis* Loureiro, *Fl. Cochinch.* 552 (1790).—*Scl. elata* Thwaites *Enum. Pl. Zeyl.* 353 (1864); Böckeler in *Linnaea* 38: 487 (1874); C. B. Clarke in Hook f., *Fl. Brit. Ind.* 6: 690 (1894) & in *Journ. Linn. Soc.* 36: 264 (1903); K. Schum. in *Notizbl. Bot. Gart. Mus. Berlin* 2: 98 (1898); Matsumura, *Index Pl. Japon.* 2(1): 165 (1905); Lam in *Nat. Tijds. Neederl.* 88: 194, 203, & 207 (1928).—*Scl. melanostoma* Nees ex Böckeler in *Linnaea* 38: 514 (1874).—*Scl. exaltata* & *Hasskarliana* Böckeler in *Engl., Bot. Jahrb.* 5: 511 (1884).—*Scl. haematostachys* Böckeler in *Engl. Bot. Jahrb.* 5: 112 (1884).—*Scl. Doederleiniana* Böckeler l. c. 112 (1884); Ohwi, *Cyper. Japon.* 2, 5 (1944) & *Fl. Japan* 218 (1953).—*Scl. Ploemii* Böckeler l. c. 513 (1884).—‘*Scl. margaritifera* Willd.’: C. B. Clarke in *Journ. Soc.* 36: 265 (1905); Matsumura, *Index Pl. Japon.* 2 (1): 165 (1905).—‘*Scl. scrobiculata* Nees’: C. B. Clarke l. c.

266 (1903); Matsumura, l. c. 165 (1905).—‘*Scl. hebecarpa* Nees’: C. B. Clarke ex Léveillé in Bull. Acad. Intern. Géogr. Bot. **14**: 203 (1904).—*Scl. luzonensis* Palla in Allg. Bot. Zeitschr. **13**: 49 (1907).—*Scl. cochinchinensis* (Lour.) Druce in Rep. Bot. Exch. Club Brit. Isls. **4**: 646 (1917).—*Scl. chinensis* Kunth var. *luzonensis* (Palla) Uittien in Rec. Trav. Bot. Néerl. **32**: 201 (1935).

Kyushu (Is. Yakushima), Ryukyus, Formosa—S. China, India, Indo-China, Malaysia, Australia. Japanese name: *Oh-shinjugaya*.

**166. *Scleria levis*** Retzius, Observ. 4, 13 (1786); S. T. Blake in Journ. Arn. Arb. **35**: 226 (1954); T. Koyama in Contrib. Inst. Bot. Univ. Montréal, 70: 62 (1957).

*Scl. zeylanica* Poirlet, Encycl. Meth. **7**: 3 (1806).—*Scl. hebecarpa* Nees ex Wight, Contrib. Bot. Ind. 117 (1834); Ohwi, Cyper. Japon. 2, 6 (1944) & Fl. Japan 218 (1953).—*Scl. Neesiaan* Hook. & Arn., Bot. Beech. Voy. 229 (141).—*Scl. pubescens* Steudel, Synops. Pl. Glumac. **2**: 168 (1855).—*Scl. japonica* Steudel, Synops. Pl. Glumac. **2**: 169 (1855); Franch. & Savat., Enum. Pl. Japon. **2**: 122 (1877).—*Scl. vestita* Böckeler in Linnaea **38**: 482 (1874).—*Scl. Dietrichiae* Böckeler in Flora **58**: 121 (1875).—*Scl. Wichurai* Böckeler in Engl., Bot. Jahrb. **5**: 510 (1884).

Honshu: Kii, Shinjo-mura. T. Koyama (TI!); Seto-Kayayama. G. Koidzumi (KYO!)—Shikoku, Kyushu, Ryukyus, Formosa—India, China, Malaysia, New Caledonia, Australia. Open wet spots on hillsides. Japanese name: *Shinju-gaya*.

**167. *Scleria caricina*** (R. Br.) Bentham, Fl. Austral. **7**: 426 (1878); C. B. Clarke in Hook. f., Fl. Brit. Ind. **6**: 688 (1894); Kükenth. in Engl., Bot. Jahrb. **69**: 261 (1938).

*Diplacrum caricinum* R. Brown, Prodr. Fl. Nov. Holl. **1**, 241 (1818); Ohwi, Cyper. Japon. 2, 3 (1944) & Fl. Japan, 217 (1953); S. T. Blake in Journ. Arn. Arb. **35**: 233 (1954).—*Scl. axillaris* Moon, Cat. Pl. Ceylon 62 (1824), nom.—*Diplacrum tridentatum* Brongn., Duperr. Voy. Bot. Ind. 119 (1834).—*Olyra malaccensis* Wall. ex Kunth, Enum. Pl. **2**: 360 (1837), (1837), pro syn.—‘*Scl. Onoei* Franch. & Savat’: Makino in Bot. Mag. Tokyo **10**: 313 (1896); Matsumura, Index Pl. Japon. **2** (1): 165 (1905).

Honshu (Kwanto district and westwards), Shikoku, Kyushu, Ryukyus, Formosa—S. China, India, Ceylon, Malaysia, Australia. Open wet places in lowlands. Japanese name: *Kagashira*, *Hime-shinjugaya*.

## ADDENDA

P. 118, after *Fimbristylis dipsacea* var. ***verrucifera*** T. Koyama add a synonym:

*F. verrucifera* (Maxim.) Makino in Bot. Mag. Tokyo (**9**): 259. 1895. comb. nud. &) **17**: 46 (1903); Ohwi, Cyper. Japon. 2, 56 (1944).

## LITERATURE CITED OUTSIDE THE TAXONOMIC ENUMERATION

1. Ascherson, P. u. Graebner, P.: Synopsis der Mitteleuropäischen Flora. Bd. 2, 2 Teil. (1902-4).
2. Bernard, C.: Floral histogenesis in the Monocotyledones. 2. The Cyperaceae. Austr. Journ. Bot. 5: 115-128 (1957).
3. Benl, G.: Systematik der Gattung *Gahnia* Forst. Bot. Arch. 40: 151-257. (1940).
4. ———: Zur Systematik der Cyperaceengattung *Gahnia* Forst. Engl., Bot. Jahrb. 75: 82-89 (1950).
5. Bentham, G. & Hooker, J. D.: Genera plantarum 3. (1883).
6. Blaser, H. W.: Studies in the morphology of the Cyperaceae. I. Morphology of the flowers. A. Scirpoid genera. Amer. Journ. Bot. 28: 542-551 (1941).
7. ———: Ditto. B. Rhynchosporoid genera. Ditto 28: 832-838 (1941).
8. ———: Ditto. II. The prophyll. Ditto 31: 53-64 (1944).
9. Čelakowsky, L.: Über die ährchenartigen Partialinflorescenzen der Rhynchosporeen. Ber. Deutsch. Bot. Ges. 5: 148-152 (1887).
10. Clarke, C. B.: On *Hemicarex* and its allies. Journ. Linn. Soc. 20: 374-403 (1884).
11. ———: Cyperaceae in Thiselton-Dyer, Flora of tropical Africa 8: 266-524 (1902).
12. ———: New genera and species of Cyperaceae. Kew Bull. Add. Ser. 8, 1-196 (1908).
13. ———: Illustrations of Cyperaceae. London. (1909).
14. Eichler, A. W.: Blütendiagramme 1. (1875).
15. Endlicher, M.: Genera plantarum 1. (1836).
16. Goebell, K.: Über den Bau der Ährchen und Blüten einiger javanischer Cyperaceen. Ann. Jard. Bot. Buitenz. 7: 120-140 (1888).
17. ———: Organographie der Pflanzen 3. (1933).
18. Holm, Th.: The clado- and anthophyllon in the genus *Carex*. Amer. Journ. Sci. 2: 214-220 (1896).
19. Holtum, R. E.: The spikelets in Cyperaceae. Bot. Rev. 14: 525-541 (1948).
20. Kern, J. H.: Notes on Malaysian and some S. E. Asian Cyperaceae VII. Act. Bot. Neerl. 7: 786-800 (1958).
21. Koyama, T.: A new classification of the genus *Cladium* in a wide meaning. Bot. Mag. Tokyo 69: 59-67 (1956).
22. ———: Taxonomic study of the genus *Scirpus* Linné. Journ. Fac. Sci. Univ. Tokyo, III, 7: 271-366 (1958).
23. ———: *Mapania* and *Thoracostachyum* are congeneric. Bull. Arts & Sci. Div., Ryukyu Univ. 3, 73-75 (1959).
24. Kükenthal, G.: Cyperaceae-Caricoideae. (1909).
25. ———: Cyperaceae-Scirpoideae-Cypereae. (1935-36).
26. ———: Vorarbeiten zu einer Monographie der Rhynchospor(o)ideae, 1-20. Fedde, Repert. 44-53 (1938-44) & Engl., Bot. Jahrb. 74-75 (1949-52).
27. Kunth, K. S.: Über die schlauchartigen Organs, welches in der Gattung *Carex* das Pistile und später die Frucht einhüllt. Wigmans Arch. 1 (2): 349-556 (1835).
28. Levyns, M. R.: A comparative study of the inflorescence in four species of *Schoenoxiphium* and its significance in relation to *Carex* and its allies. Journ. S. Afr. Bot. 11: 79-89 (1945).
29. Mattfeld, J.: Zur Morphologie und Systematik der Cyperaceae. Proc. Intern. Bot. Congr.

Amsterdam, 330-332 (1915).

30. ———: Cyperaceae, in Engler-Diels, Syllabus der Pflanzenf. 11 Aufl. 142-143 (1936).
31. ———: Das morphologische Wesen und die phylogentische Bedeutung der Blumenblätter. Ber. Deutsch. Bot. Ges. **56**: 86-116 (1938).
32. Monoyer, A.: Contributions à l'anatomie du genre *Scirpus*. Inst. Bot. Archiv., Univ. Liège **11**: 1-185 (1934).
33. Nees ab Esenbeck: Übersicht der Cyperaceen-Gattungen. Linnaea **9**: 273-308 (1835).
34. Ohwi, J.: Cyperaceae Japonicae, Pt. 2. Mem. Coll. Sci. Kyoto Imp. Univ. B, **18**: 1-182 (144).
35. Palla, E.: Über den morphologische Wert der Blüte der Gattung *Lipocarpa* und *Platylepis*. Ber. Deutsch. Bot. Ges. **23**: 316-323 (1905).
36. ———: Über *Hemicarpha*. Österr. Bot. Zeitschr. **11**: 417-422 (1908).
37. Pax, F.: Beiträge zur Morphologie und Systematik der Cyperaceen. Engl., Bot. Jahrb. **7**: 287-318 (1886).
38. ———: Cyperaceae. Engl. u. Pr., Nat. Pflanzenfam. **2** (2): 98-126 (1886).
39. Peisl, P.: Die Binsenform. Ber. Schweiz. Bot. Ges. **67**: 99-213 (1957).
40. Pfeiffer, H.: Vorarbeiten zur systematischen Morphologie der Cyperaceae-Mapanieae. Bot. Arch. **12**: 446-472 (1925).
41. ———: Zur Systematik der Gattung *Chrysithrix* und anderer Chrysithichinae. Ber. Deutsch. Bot. Ges. **38**: 6-10 (1920).
42. Raymond, M.: Some new or critical *Scirpus* from Indo-China. Nat. Canad. **84**: 111, 150 (1957).
43. Rüter, E.: Über Vorblattbildung bei Monocotylen. Flora **110**: 193-261 (1918).
44. Savile, D. B. O. & Calder, J. A.: Phylogeny of *Carex* in the light of paraticism by the smut fungi. Canad. Journ. Bot. **31**: 164-174 (1953).
45. Schutze-Motel, W.: Entwicklungsgeschichtliche und vergleichend-morphologische Untersuchungen im Blütenbereich der Cyperaceae. Engl., Bot. Jahrb. **78**: 129-170 (1959).
46. ———: Dulichieae, eine neue Tribus der Cyperaceae-Scirpoideae. Willdenowia **2**: 170-175 (1959).
47. Snell, R. S.: Anatomy of the spikelets and flowers of *Carex*, *Kobresia* and *Uncinia*. Bull. Torr. Bot. Club **63**: 277-295 (1959).
48. Tanaka, N.: 'Isusei-no-Mondai' Tokyo (1948). [=Aneuploidy in the Cyperaceae].
49. Turpin, P. I. F.: Mémoire sur l'inflorescence des Graminées et des Cypéracées. Mém. Mus. d'Hist. Nat. Paris, **5**: 426-492 (1819).
50. Uittien, H.: Studies in Cyperaceae-Mapanieae, I-V. Rec. Trav. Bot. Néerl. **33**: 133-155 (1933).
51. ———: Ditto, VI-VIII. Ditto, **36**: 277-291 (1936).



## I N D E X

(Synonyms in italics)

<i>Abildgaardia</i>	71	<i>Callistachys</i>	81	<i>globiceps</i>	123
<i>Eragrostis</i>	117	<i>Calyplostylis</i>	77	<i>boninsimae</i>	123
<i>fimbristylodes</i>	117	<i>articulata</i>	132	<i>glomeratum</i>	122, 123
<i>fusca</i>	117	<i>Calyptralepis</i>	77	<i>jamaicense</i>	73, 121
<i>monostachyos</i>	117	<i>Carex</i>	80	<i>chinense</i>	121
<i>Acorellus</i>	72	<i>Cariceae</i>	78	<i>japonicum</i>	121
<i>Acrolepis</i>	70	<i>Caricina</i>	81	<i>leptostachyum</i>	121
<i>Actinoschoenus</i>	76	<i>Caricinella</i>	81	<i>Mariscus</i>	121
<i>Adupla</i>	72	<i>Caricoideae</i>	78	<i>nipponense</i>	123
<i>Albikia</i>	68	<i>Carpha</i>	77	<i>occidentale</i>	121
<i>Andropogon</i>		<i>Caustis</i>	75	<i>rubiginosum</i>	123
<i>dulce</i>	98	<i>Cenerischia</i>	81	<i>Clavula</i> (cf. 7(6): 283)	
<i>Anerma</i>	77	<i>Cephaloschoenus</i>	77	<i>acicularis</i>	87
<i>Anogyna</i>	78	<i>parvus</i>	134	<i>comosa</i>	87
<i>Anosporum</i>	72	<i>Cepharoscirpus</i>	68	<i>ovata</i>	93
<i>Arthrostylis</i>	76	<i>Ceratoschoenus</i>	77	<i>Cobresia</i>	79
<i>Ascolepis</i>	70	<i>Chaetocyperus</i>	71	<i>Cobria</i>	79
<i>Asterochaete</i>	77	<i>acicularis</i>	88	<i>Cosularia</i>	74
<i>Asteroschoenus</i>	77	<i>Chaetospora</i>	76	<i>Courtoisia</i>	72
<i>Atomostylis</i>	72	<i>albescens</i>	126	<i>Cryptangieae</i>	77
<i>Aulacorhynchus</i>	74	<i>calostachya</i>	125	<i>Cryptangium</i>	78
		<i>imberbis</i>	126	<i>Cryptoglochin</i>	81
		<i>madagascariensis</i>	134	<i>Cyathochaete</i>	73
<i>Baeothrion</i> (cf. 7 (6): 293)		<i>tenax</i>	126	<i>Cyathocoma</i>	74
<i>fistulosum</i>	98	<i>umbellulifera</i>	126	<i>Cyclocampe</i>	76
<i>nanum</i>	87	<i>Chamaexiphium</i>	70	<i>waigionensis</i>	125
<i>pusillum</i>	87	<i>Chapelliera</i>	73	<i>Cyclocarpa</i>	76
<i>Baumea</i>	73, 122	<i>glomerata</i>	123	<i>waigionensis</i>	125
<i>Brownei</i>	123	<i>Chlorocharis</i>		<i>Cylindrolepis</i>	72
<i>glomerata</i>	123	<i>capitata</i>	93	<i>Cylindropus</i>	77
<i>rubiginosa</i>	123	<i>palustris</i>	95	<i>Cymophyllus</i>	81
<i>Beera</i>	68	<i>Choris(z)andra</i>	69	<i>Cyperaceae</i>	64
<i>Bequeleria</i>	77	<i>Chlorocyperus</i>	72	<i>Cypereae</i>	71
<i>Bisboeckelerieae</i>	68	<i>Chondrachne</i>	69	<i>Cyperus</i>	72, 119
<i>Bisboeckelerinae</i>	68	<i>Chondrolomia</i>	77	<i>acicularis</i>	87
<i>Boeckleria</i>	74	<i>Choricarpa</i>	69	<i>complanatus</i>	105
<i>Borabora</i>	72	<i>Chrysithrix</i>	69	<i>dulcis</i>	98
<i>Buekia</i>	74	<i>Chrysitricheae</i>	68	<i>monostachyos</i>	117
<i>Bulbostylis</i>	71, 100	<i>Chrysitrichinae</i>	68	<i>ovatus</i>	93
<i>barbata</i>	104	<i>Cladieae</i>	72	<i>parvulus</i>	87
<i>capillaris</i>	100, 102	<i>Cladiinae</i>	72	<i>setaceus</i>	88
<i>alpina</i>	103	<i>Cladium</i>	72	<i>Cyplolepis</i>	72
<i>capitata</i>	103	<i>asperum</i>	124		
<i>trifida</i>	103	<i>bahiense</i>	121	<i>Decalepis</i>	74
<i>densa</i>	103	<i>boninsimae</i>	123	<i>Diaphora</i>	77
<i>japonica</i>	103	<i>brevistigma</i>	123	<i>cochinchinensis</i>	138
<i>ovata</i>	93	<i>chinense</i>	121	<i>Dichostylis</i>	72
<i>palustris</i>	95	<i>dubium</i>	122	<i>Dichroma</i>	77
<i>trifida</i>	103				

<i>Dichromena</i>	77	<i>cyclocarpa</i>	96	<i>pileata</i>	97
<i>alba</i>	132	<i>dulcis</i>	97	<i>planiculmis</i>	98
<i>glauc</i>	130	<i>tuberosa</i>	98	<i>plantaginea</i>	98
<i>Didicidium</i>	72	<i>erythrochlamys</i>	98	<i>plantaginoides</i>	98
<i>Didymonema</i>	75	<i>esculenta</i>	98	<i>purpurascens</i>	89
<i>Diplacrum</i>	77, 135	<i>eupalustris</i>	95	<i>pygmaea</i>	89
<i>caricinum</i>	135	<i>fistulosa</i>	98	<i>quaesita</i>	95
<i>tridentatum</i>	139	<i>Gambleana</i>	89	<i>sachalinensis</i>	97
<i>Diplasia</i>	68	<i>geniculata</i>	93	<i>Savatieri</i>	97
<i>karataefolia</i>	68	<i>intersita</i>	95	<i>setacea</i>	93
<i>Diplocarx</i>	81	<i>japonica</i>	89	<i>Shimadai</i>	89
<i>Diplochaete</i>	77	<i>thermalis</i>	90	<i>soloniensis</i>	93
<i>Diploscyphus</i>	78	<i>kamtschatica</i>	97	<i>nipponica</i>	93
<i>Distimus</i>	72	<i>reducta</i>	97	<i>subprolifera</i>	89
<i>Dulichieae</i>	70	<i>Komarovii</i>	97	<i>subvivipara</i>	90
<i>Dulichium</i>	70	<i>Kunthei</i>	89	<i>tetraquetra</i>	91, 92
<i>Duval-Jouvea</i>	72	<i>Kuroguwai</i>	97	<i>Tsurumachii</i>	91, 92
		<i>laxiflora</i>	98	<i>Wichurai</i>	92
<i>Echinolytrum</i>	71, 100	<i>Lereschii</i>	94	<i>yezoensis</i>	92
<i>dipsacea</i>	101	<i>leviseta</i>	91	<i>Thomsonii</i>	89
<i>verrucifera</i>	118	<i>liukiuiensis</i>	92	<i>triflora</i>	97
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